More than 27,000 Copies a Week

Electrical World

McGraw-Hill Company, Inc. New York, May 15, 1920 Twenty-five Cents a Copy

GENERAL LIBRARY
MAY 17 1920
UNIV. OF MICH.

"Just Press a Button"

—and tell your stenographer to write for this bulletin describing the original "Just Press a Button" system of automatic control for motor-driven machinery.

The Monitor System

is complete, embodying types of controllers to exactly meet the exacting conditions of modern practice, and assuring safety to operator, motor and machine. Send for the Bulletin (No. 101) today.

Monitor Controller Company

Baltimore, Md.

Model 310
Portable
Single Phase
WATTMETER

Weston

Electrical Indicating Instruments

are unqualifiedly superior in construction, accuracy and service to any other Instruments designed for the same purposes.

Weston models include complete Switchboard and Portable groups for service on A. C. or D. C. circuits, and also many Instruments designed for special purposes.

There is a Weston model for every electrical measurement need.

Consult the Weston representative in your nearest city, or write for Catalogs or Bulletins, specifying the field that interests you.

WESTON ELECTRICAL INSTRUMENT CO., 13 Weston Ave., Newark, N. J.

New York	Cleveland	Denver	Buffalo	Seattle	Winnipeg
Chicago	Detroit	Cincinnati	Minneapolis	Toronto	Vancouver
Philadelphia	St. Louis	Pittsburgh	New Orleans	Montreal	Calgary, Alta.
Boston	San Francisco	Richmond	Jacksonville	Halifax	

And in Principal Cities Throughout the World

Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician
Published by McGraw-Hill Company, Inc.

W. H. ONKEN, Jr., Editor D. H. BRAYMER, Managing Editor
S.B.WILLIAMS, Asst. M'n'g Editor A.M.PERRY, Engineering Editor J.C.MARTIN, Western Editor ROBERT SIBLEY, Pacific Coast Editor H.S.KNOWLTON, New England Editor
Associate Editors: P.S.BIEGLER, C.T.BALDWIN, S.N.CLARKSON,
R.H.BACON, T.P.KINDIG, R.M.DAVIS, E.H.HUBERT, F.C.WELLS

Volume 75 New York, Saturday, May 15, 1920 *Number* 20

N. E. L. A. Convention

NEXT week at Pasadena, Cal., the forty-third convention of the National Electric Light Association will be held. Always of great interest and importance to the industry, this year's assembly has a special significance because it is to pass upon the reorganization program that has been drawn up at national headquarters in accordance with administration plans. The association should give its unanimous approval to this progressive movement, the details of which were explained by Executive Manager Aylesworth in our preconvention issue last week. The program of association meetings and entertainment, as printed in our recent issues, is ample assurance of a highly successful convention. On May 22 and 29 the ELECTRICAL WORLD will give its usual complete report of the proceedings.

Cornell's New President

IN THE selection of A. W. Smith, for sixteen years dean of Sibley College, to succeed Dr. Schurman as president of Cornell University, the trustees of that institution have honored an eminent technician who is also what every eminent technician is not—a man of all-around culture and development. An athlete in his younger days, president and orator of his class and an honor graduate of the university where he is now to be the head, Dr. Smith's tastes have led him to take an active interest in literature of all kinds, and we are told that, in addition to texts pertaining to his own profession, he has written other things, including rhymes. A poetical engineer, or for that matter an engineer qualified to be the president of a great institution of learning where the humanities as well as the sciences are fostered, is sufficiently unusual to draw comment; but why should not an engineer as well as other educated men possess the broadened outlook and the enriched imagination that come with the pursuit of letters?

Centralization and Over-Development

THE influence of centralized energy supply in preventing over-development of plant deserves emphasis in view of the growing recognition of the improvement in operating efficiency resulting from the co-ordination of generating stations and line facilities, either through consolidation or interconnection. The Maine Public Utilities Commission discussed this point effectively in a recent decision which will be found among the "Commission Rulings" in this week's issue. The wisdom of permitting a consolidation which will result in one public utility's occupying a large and important part of the state was under consideration, and the commission concludes that so far as hydro-electric companies are concerned, the union of relatively small companies into one large corporation is for the benefit of all the customers of each of the companies and is best for the state as a whole. This doctrine is hardly novel, to be sure; but in setting it forth the commission throws additional light upon over-development as related to centralization, and in words well worth heeding. Its recognition of the far-reaching economic advantages of centralization evinces an understanding of the less evident as well as the more patent aspects of interconnection and unification which deserves to be brought to public attention. It is one among a number of proofs that public service commissions in all parts of the nation are studying with zeal and intelligence the questions that come before them for adjustment.

Precaution Better Than Litigation

EXEMPTION from responsibility for damages caused by "acts of God," in other words, due to the uncontrollable working of natural phenomena, has always been claimed by those to whom others trust their safety. This must have been the defense at the back of the official mind of the Quebec Railway, Light, Heat & Power Company when it fought clear through to the Canadian court of last resort—the judicial committee of the British Privy Council—the suit of a number of roadside customers whose houses had been destroyed by fire caused by the conductors of the company's 2,200-volt transmission line in a storm coming into contact with the branch lines that supplied the residences. The fact that the electric supply company had not followed the ordinary practice of grounding the secondary wires was, however, to the judicial mind sufficient reason for finding for the plaintiffs, despite the company's contention that the loss was an unavoidable incident of its legal right to distribute energy by overhead lines. The great preponderance of engineering authority is, of course, on the side of the court's decision. Grounding the secondary is a requirement of the National Electrical Code, and for that matter the practice had been recommended to the Quebec company by the Canadian fire underwriters. Were consumers of electricity, along a rural road or elsewhere, forced to assume the risk of losing their houses in every violent storm, their number would naturally and with reason shrink.

Electricity in the Home

THE ELECTRICAL WORLD presents this week a somewhat exhaustive study of the use of electrical energy in the American home, particularly with reference to the actual as compared with the possible extent of this fundamental service. The degree to which electrical distribution covers the country can be written down proudly in blazing figures to mark the progress of the last quarter of a century. Nearly 60 per cent of the total population live today in territory reached by central-station service; yet only about half of this population, or 30 per cent of the total, actually enjoy

the benefits of electrical service. The proportion varies greatly, as might be expected, from part to part of the country. California leads, with 79 per cent of its people living in electrically lighted houses, and Utah is a good second, with more than 74 per cent. So much for the transmission networks that have been there developed. On the Eastern coast Massachusetts and Connecticut are in the van, but the figure for these states and for Illinois, the ranking state of the Middle West, falls to about 55 per cent. And so the list runs down, ending with Mississippi at 8.4 per cent, though in mitigation of that low figure it may be said that it represents substantially half the population reached by central stations, lack of distribution rather than lack of desire for electricity being the trouble.

These figures furnish serious food for reflection. They show very plainly that the central stations of the country as a whole have not made the most of their domestic opportunities. More than 44 per cent of the dwellings in territory actually covered by central stations are not wired, the figures running up from 7.2 per cent in Utah and 8.6 per cent in California to about 70 per cent in Pennsylvania, Maryland, Louisiana and, horrible to relate, the District of Columbia. Now, one cannot put "juice" in cold storage. It must be delivered, for the most part, as made, and the only way to deliver it to the domestic consumers with their fifteen million unwired houses is to start an energetic campaign for wiring—difficult, it is true, in these times of high prices, but necessary if electric service is to reach its full development. It was at one time considered almost beneath the dignity of central stations to cater to the small consumer, but the aggregate amount of load which he can absorb is very large and the total revenue correspondingly large and well worth getting. Especially is this true since the cost of extending the area of service is great, and the more service to be extracted from existing territory covered the better from the standpoint of economy.

Of equal importance is the increasing use of electrical appliances in domestic service, which is capable of adding very largely to the income of the central stations with very great advantage to the consumer. It is to the appliance load that electric companies must chiefly look for the fuller utilization of their lines, especially those lines outside the industrial districts. Wherever active wiring and appliance campaigns have been waged good results have been shown, results which year by year will become more plainly evident. Once a house is wired and equipped with appliances its load shows a steady increase as time goes on, and this again means intensive use of the distribution system, particularly as the larger part of such load is off the general peak. The wiring of the two hundred thousand houses likely to be built this year will for the most part go on as a matter of course, but the central stations should see to it, as far as possible, that new installations are laid out with reference to the use of electrical appliances so that no rearrangements will hinder their installation. The wiring of old houses presents a more difficult problem, and every effort ought to be made to work out and encourage methods of minimum cost for this important work. Broadly, there is an opportunity for more than doubling the domestic load within reach of existing central stations, and it is emphatically up to the central stations themselves to win as much as possible of this added output.

Power Needs of Eastern Industries

MUCH has been said in the last few years in favor of the wholesale distribution of electric power, and the exigencies of war-time demand have pointed more plainly than ever to this particular need. Lieut.-Col. Lacombe in this number gives a striking analysis of the situation as it now exists as well as details concerning proposed remedial measures. There is no doubt that the nation stands today in a very critical industrial situation. The war which turned the world upside down has left in its wake an enormous increase in the cost of everything. This may be attributed to many co-operating causes, of which not the least is the world inflation of currency, amounting to something like one hundred billion dollars. The most conspicuous feature of the industrial situation is the unprecedented rise in wages. Second only to this stands the general increase in cost of production.

During the last five years the cost of coal has more than doubled, and the survey of power plants carried on by the government showed that the waste in the utilization of this high-cost fuel was startling, especially in the numerous relatively small plants in which the consumption ran as high as 7 lb. (3.17 kg.) of coal per unit of power furnished. Now, aside from all questions of conservation, increase of operative efficiency would mean a very great economic gain. Colonel Lacombe estimates that the introduction of superpower plants with suitable distributing systems would save in the Northeastern States alone more than $18,000,000 worth of fuel, equivalent to 12 per cent on more than $300,000,000—a sum fully ample to carry out the projects outlined. The total amount of fuel supposed to be available in this country is more than three thousand billion tons, a quantity which sounds very big, but in fact is not nearly so great as the figures indicate. Most of it is extremely low-grade lignite or the meanest of bituminous coals. Much of it is of a quality difficult and costly to transport in the face of increasing railroad charges, and as time goes on deep mining must be resorted to more and more, implying lessened output per man and further increased expense. Conservation therefore must be reckoned with, not in terms of a future of three thousand billion tons, but right here and now to avert prohibitive increases in price.

The hydraulic resources of the country are very great, more than 50,000,000 hp., but of this a considerable majority is in the Rocky Mountain region and west thereof. New England and the Middle Atlantic States are not now rich in undeveloped powers which can be brought into service at moderate cost. It is this consideration which impels the study of superpower stations worked from coal at the mine's mouth, if feasible, and preferably where the cheaper grades of fuel can be utilized. The project put into concrete form by Colonel Lacombe involves first the Northeastern territory—that in New York, New Jersey and Pennsylvania—and it gives the impression of thorough feasibility from an economic standpoint. It is our opinion, however, that if anything of the kind is to be undertaken under government auspices it should go much further. There are now in existence various huge networks covering areas much greater than that here contemplated which, although interconnected, are still not efficient from the industrial

standpoint. They have been built up of too many heterogeneous units in size, character, voltage and even frequency and, while united, they are not so tied together as to reap the full advantages of interconnection. If the super-power plant project is worth carrying out, and we think it is, it is worth carrying out on a scale suitable to the larger problem in hand and with a view to the future as well as the present.

Oil Fuel on the Pacific Coast

WE HAVE frequently had occasion to consider the question of fuel oil for central stations and have been inclined to sound a note of caution on account of uncertain prices. The economic conditions, however, which hold true in the East are not altogether maintained on the Pacific Coast. Through the East and a good part of the Middle West coal is relatively of low cost, and the distances of transportation are, except on the Atlantic seaboard, not very great. On the Pacific slope the situation is altered. The coal available locally is in relatively small supply and not of a particularly good quality, and the use of good steam coal necessitates a very long haul. California, however, is a large oil-producing state, and some of the Mexican oil fields are not far distant. In this issue W. F. Durand and C. H. Delany consider the economic side of the matter with respect to the steam auxiliary plants which necessarily play no inconsiderable part in the transmission systems along the Coast. The hydro-electric supply has not been yet developed up to the point where storage is sufficient to carry the plant through in a dry season, and there have been several successive dry seasons. Consequently local steam plants have come into considerable use, with units as high as 20,000 kva.

Of the available fuels California oil is the one generally used. In certain localities natural gas comes into play with good advantage, but the supply is as yet somewhat limited. Of other fuels coal and sawmill refuse are employed, but only to a limited extent, on account of the cost of the former and the bulk of the latter and the difficulty of transporting it. The coal supply is most freely available in the Northwest, and if any further considerable supply is necessary it must probably be derived from the Alaskan mines, not yet developed, as freight costs from Eastern coal fields are prohibitive. Unless the California oil production increases, there is likely to be a large demand on the Mexican oil, which is heavier and more viscous than the native product and consequently somewhat less desirable as a fuel. In general, the auxiliary steam plants thus far considered have been of moderate size, boiler units of 600 to 800 rated horsepower being the maximum.

In burning the oil both steam and mechanical atomizers are in use, the latter having some advantages when output has to be forced. Some furnaces are being constructed with a view to an easy change to coal later. In our judgment this precaution is less necessary in the West than in the East. At all events, it pays to furnish liberal furnace capacity, more liberal than has been customary until recently. Economizers have proved to be somewhat less useful than with coal-burning plants owing to the smaller degree of heat in the flue gases when oil is properly burned. There is a steady tendency to work toward the higher steam pressures and higher superheat. The authors of this week's article point out that as between these two, for the same ultimate steam temperature, there is a tendency to slightly better economic results by forcing the pressure rather than the superheat. The questions of actual relative cost, including the capital charges and upkeep on the higher steam pressures, have not been thoroughly worked out, particularly near the present limiting temperatures for the steam, determined by available materials of construction. In the Pacific Coast oil-fired plants there is an interesting tendency toward automatic fire-room control, from which some gain in economy has been reported. On the whole, it appears to us that oil firing is a better proposition in this Western country than it is in the East, and one less likely to suffer from price changes in the future.

Ownership of Trunk Lines Along Electrified Railroads

BECAUSE of the small size and widely separated locations of many towns in the Northwest, it is financially impossible for the utilities to provide electric service from high-voltage transmission lines at the present time. However, towns along railroads that are to be electrified can be served if the new transmission lines are built parallel to the right-of-way and the step-down apparatus is owned by the power company instead of the railroad. This raises the question whether railroads that plan to electrify in the future should not give up the idea of operating their own trunk lines and thereby enable small communities along the road to obtain service.

The argument has been advanced by one electrified railroad that it does not want to have these trunk lines subjected to the interruptions of service which might be caused by having other loads attached to them. With the protective equipment now available, however, service to towns along the line should not reduce the reliability of service to the railroad. Surely an electric service company whose special business is to generate and transmit electricity is more able to maintain uninterrupted service than a company which gives only part of its attention to this problem. Furthermore, since the growth of a community is so materially hastened by electric service, railroads should welcome this means of developing towns along their rights-of-way. Still other advantages would result from the power company owning the trunk line and step-down apparatus. The railroad would be relieved of the investment, operating and maintenance expense connected therewith. In addition, measurement of the power and energy supplied to the railroad would be greatly simplified by meters on the low-tension side in place of high-tension meters at various points where the power company feeds in. Again, where railroads parallel each other, transmission lines can be built by the electric service company to serve both much more economically than the individual roads can build their own independent lines. In view of the ultimate prospect of extensive electrification of railroads in certain sections, this question of trunk-line ownership presents aspects of great economic importance to the electrical development of the sections passed through. If it is to be approached and properly solved on the basis of service to the public, electric service companies will have to take the initiative.

Edward N. Hurley

The man who turned chaos in the Shipping Board during the war into orderly production, a pioneer manufacturer of electrically operated home-labor-saving devices and a commanding personality as a business man and in public office

BY WAY of the apprentice-boy route, Edward Nash Hurley has stepped from one success to another until through sheer ability without political or monetary pull he stands acclaimed as one of the foremost straight thinkers in American business, whether it be at Washington on national matters or at the head of his own interests among fellow business men. Although he has devoted considerable time to national affairs, first as trade commissioner to Latin-American countries, next as Federal Trade Commissioner, and finally with marked credit as chairman of the United States Shipping Board during the war, he has always been classed as a business man and never as a politician.

Mr. Hurley was born at Galesburg, Ill., fifty-six years ago on July 31 of this year. At Chicago, when not yet of age, he entered the railway shops of the Chicago, Burlington & Quincy Railroad, and at twenty-four was an expert locomotive engineer. When a strike deprived him of a job he became interested in an invention involving the use of compressed air to operate hand tools and decided to establish a factory for the manufacture of these devices. In a manner typical of his determination to overcome financial obstacles, he carried his idea to England. After organizing the International Tool Company of England he returned to Chicago to establish the Standard Pneumatic Tool Company and became its president in 1896. Six years later he sold his interest in this company and took up farming. In 1906, however, he conceived the idea of utilizing the electric motor as a labor saver and organized the Hurley Machine Company in Chicago to make scrapers for dressing hardwood floors and electrically operated washing machines. The reversing-cylinder washer, a domestic size of electric ironing machine and an electric cleaner have since been developed. Three large factories, employing 2,000 persons, and a fourth, larger than all the rest, measure the success of his accomplishments in this field.

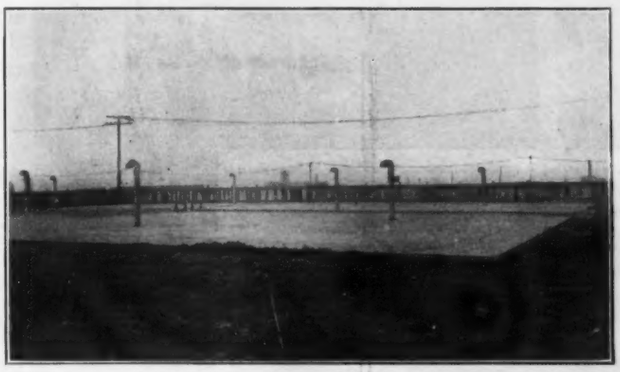
To men of the type of Edward N. Hurley the American public owes much, for only on conceptions of service such as his can those in charge of the business and production of American industries found the solution of our national problems. His book, published in 1916, on "The Awakening of Business," dealing with the relation of government to business, is full of straight thinking and common sense on the problems of the day, and will prove a factor in the perpetuation of his name.

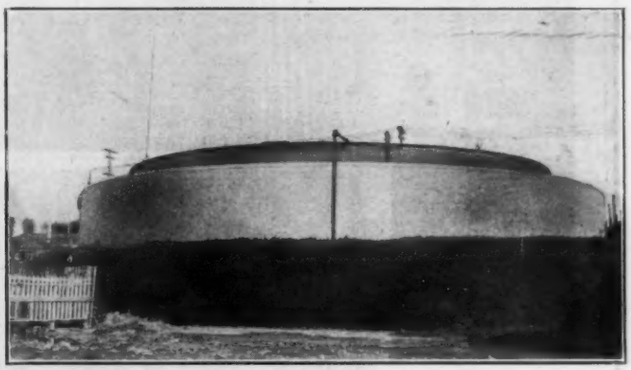
Steam-Electric Generation in Far West

Present Tendencies of Design—Leaning Is Toward Higher Pressures and Higher Superheat, Centrifugal Pump Auxiliaries, Automatic Control and Use of Recording Meters in the Boiler Room

By W. F. DURAND and C. H. DELANY

USE of oil as fuel is the one distinctive feature of steam-plant generation on the Pacific Coast. Natural gas, coal and sawmill refuse are burned in some sections, but not extensively. This oil is burned under boilers 600 hp. to 800 hp. in size and operating up to 200 per cent of rating. There is a general tendency toward higher superheat temperature and toward higher pressures, which run as high as 250 lb. For auxiliaries turbine-driven centrifugal pumps are the practice. The largest units operating in this section are rated at 20,000 kva. Careful supervision, especially in the boiler room, is becoming more widely recognized as the best means for securing high efficiency of operation.





CONSTRUCTION OF LARGE FUEL-OIL TANKS

At left, vent pipes are fixed on top of the main fuel-oil tanks of the Long Beach plant of the Southern California Edison Company to allow gases to escape. The mouth of these pipes is covered with a fine mesh screen.

At right, a concrete wall surrounds the 30,000-barrel oil-storage tank at the plant of the Sierra & San Francisco Power Company to prevent the oil spreading in case of a leak in the tank.

The present shortage of hydro-electric power has created an unusual situation in that the demand for power is so great that steam plants intended originally to act merely as standby installations and to assist the hydro-electric systems in case of trouble are now being operated at full capacity and carrying a large proportion of the total load. Other steam plants are being planned, and those already under way are being rushed to completion so as to tide over the emergency fast becoming acute.

California oil is used almost exclusively along the Western Coast. However, unless its production is greatly increased, in the next few years Mexican oil will be introduced into California as it has been in Arizona, Texas and the Atlantic Coast. Mexican oil is generally much heavier, dirtier and more viscous than California oil. Oil in the Panuco field runs in gravity about 12 deg. Beaumé and is so viscous that it cannot be unloaded from a car without being heated and must be kept up to a temperature of 120 deg. Fahr. (50 deg. C.) in the pipes in order to keep it flowing. It is therefore necessary to use large pipes, covered on the outside and containing internal heating pipes through which steam or hot water is passed. Mexican oil usually contains a large proportion of silt, and it is necessary to provide strainers at both the suction and discharge of pumps as well as at the burners. To burn properly it must be heated up to 190 deg. Fahr. (90 deg. C.) and in some cases even as high as 250 deg. Fahr. (110 deg. C.).

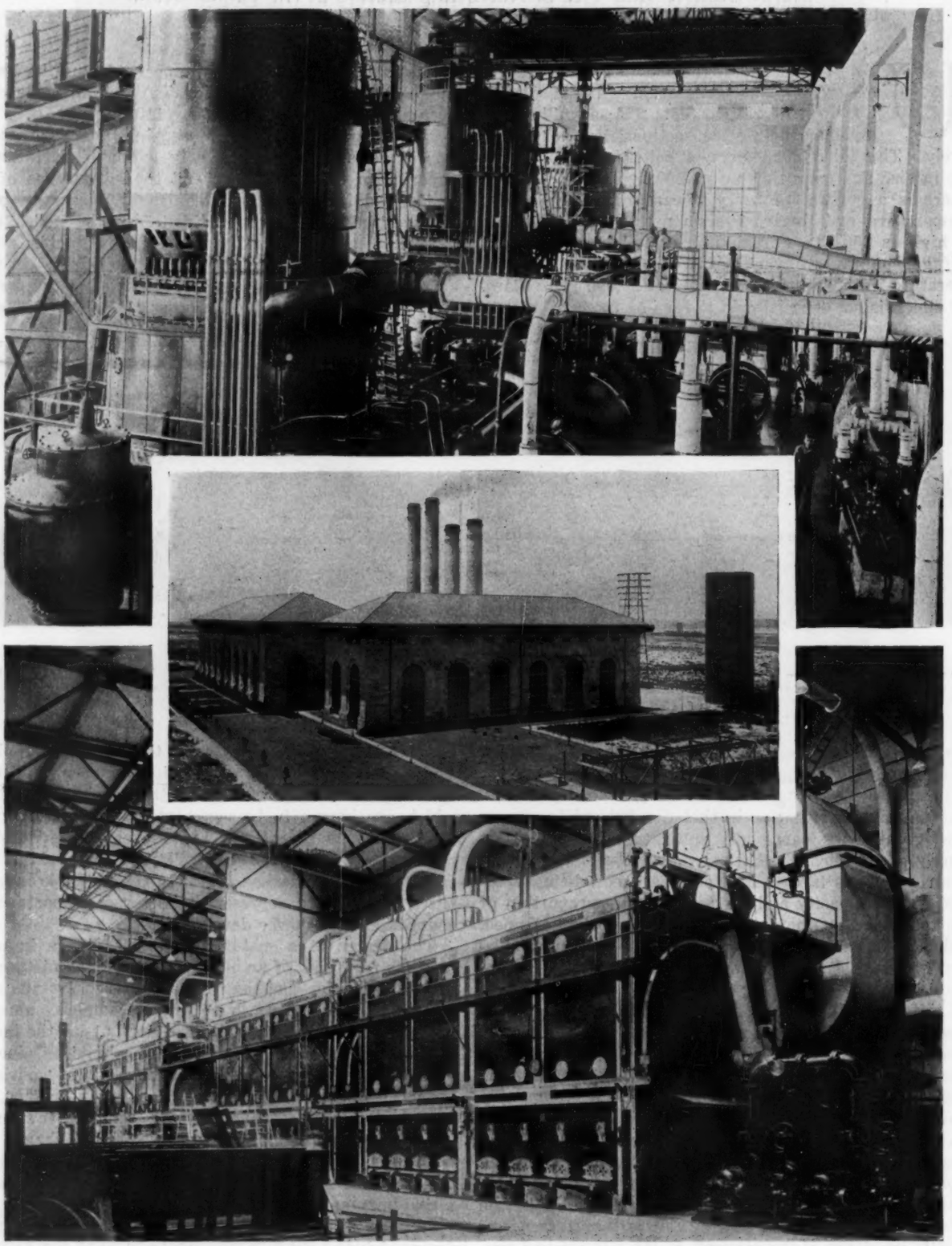
Natural gas is now being used in Bakersfield and in Los Angeles. This is the only available fuel that is superior to fuel oil. It has all the advantages of oil, and in addition does not require atomizers or bulky storage tanks if it is piped direct from the wells.

Coal is used quite extensively in the Pacific Northwest, both in pulverized form and stoker-fired. In California, however, there is no coal marketed at the present time except for domestic purposes. If oil continues to advance in price, the question of the available supply of coal will become of paramount importance. The most promising source appears to be the Alaskan coal fields, which are known to be very extensive and to contain coal of excellent quality. Vast developments must be made, however, in the way of transport and docking facilities before Alaskan coal becomes available in quantities sufficient to represent a factor of importance in connection with power developments.

The design of a coal-burning plant differs in many respects from that of an oil-burning plant. Boilers must be set higher for coal than for oil so as to provide room for mechanical stokers or to provide ample combustion space for powdered fuel. A basement under the boilers is required for handling ashes. The building must be high enough to allow for coal bunkers and conveyors above the boilers, larger smokestacks are necessary, and forced-draft apparatus is usually required. In most cases, therefore, it would be impracticable to change over existing oil-burning plants to coal-burning plants, although, on the other hand, it is an easy matter to change a coal-burning plant to an oil-burning one.

In some cases oil-burning plants have been specially designed with a view to converting them to coal-burning at a future date. However, since it is impossible to anticipate the rapid changes that occur in engineering practice, the extra expense involved in thus attempting to design for the future is hardly warranted.

Long Beach Steam Plant of Southern California Edison Company



This station is notable for its generous equipment of recording instruments in the boiler room. Above is the newest installation of boilers in the plant, No. 3 bank. The view of the engine room shows a 20,000-kw. turbine, the largest size installed on the Pacific Coast, and two other turbines rated at 15,000 kw., 12,000 kw. respectively. Note in the center picture the short stacks required for burning oil.

Another fuel used quite extensively in the Northwest is the refuse from sawmills, known as hog fuel. This is an extremely cheap fuel if used close to the mill. Owing to its bulk, however, it is difficult to transport, and its field of usefulness is therefore limited.

LOCATION OF STEAM-ELECTRIC POWER PLANTS

Economy of design in the vast hydro-electric transmission lines of the West, in which steam-electric generation serves as an auxiliary, necessitates the location of the steam-electric plant as near to the large industrial centers as possible. This reduces to a minimum the distance through which the steam-generated power must be transmitted, thus avoiding the necessity of burning extra fuel to make up for transmission losses. The exact location within the industrial center depends mainly on the four following factors: (a) An adequate supply of water for condensing purposes; (b) access to deep water, to enable oil to be delivered by barge; (c) railway facilities for the delivery of machinery and possible delivery of fuel; (d) proximity of the transmission lines through which power is delivered from the hydro-electric system.

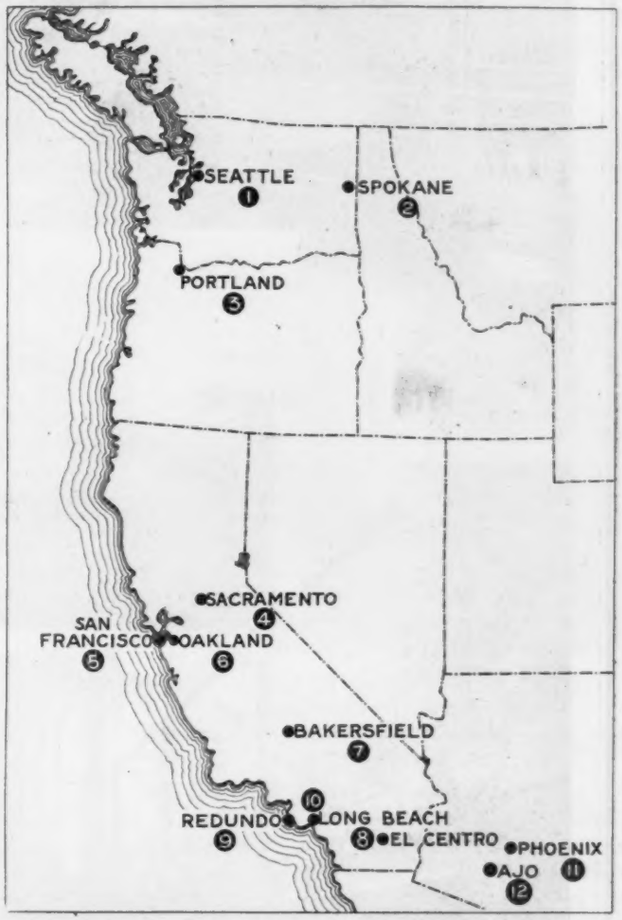
A large interconnected hydro-electric system may have one large auxiliary steam plant or several small ones. As most of the hydro-electric systems in the West have grown to their present huge proportions through combinations of several smaller systems, in the majority of cases there are several steam plants connected to each system. While, if properly designed, a large single plant is in general more economical to operate than a number of small plants, the distribution losses may be much less in the latter case. The question of economical distribution is, therefore, a very important factor in determining both the size and the location of a plant.

SIZE OF STEAM PLANT UNITS

The size of turbine selected for a plant depends largely on the question of spare units required. If the units are too large, this spare requirement results in too expensive a plant. In the case of steam plants interconnected with a large hydro-electric system the necessity for spare units is not so great, since it is always possible to take the load off one plant temporarily and carry it on another. The largest single unit on the Pacific Coast at the present time is rated at 20,000 kw., although machines as large as 45,000 kw. are operating in the East.

The size of the boiler unit is also affected by the necessity of having enough spare boilers to permit frequent cleaning and repairs. It is desirable in any central station to have at least four or six boilers. In the East many plants have boilers up to 1,500 hp. or 2,000 hp. each, but on the Pacific Coast 600 hp. to 800 hp. is the maximum. For oil burning the best results are obtained with boilers having a relatively large combustion chamber, and the present tendency is to raise boilers higher than formerly so as to increase the furnace volume and enable the boilers to be forced to high capacities. Oil-burning boilers have not as yet been forced to such high overloads as has been done in Eastern cities with coal-burning boilers. Capacities of 200 per cent of rating have been obtained with steam atomizing burners, and a recent plant on the Atlantic Coast firing Mexican oil with mechanical atomizing burners has operated up to 300 per cent of rating. Mechanical atomizing burners produce a softer flame that is less damaging to brickwork than the steam atomizing burner, and give a higher boiler efficiency at high overloads, owing to the more perfect combustion maintained when firing large quantities of oil in furnaces of limited volume. They require strong forced draft, however, and the power required for this as well as the extra steam used for heating and pumping tends to offset these advantages.

Owing to the small amount of excess air required with oil burning, there is less heat in the gases leaving the boiler and hence less necessity for economizers. At present prices of fuel oil it would undoubtedly pay to install economizers in any plant that is to be operated at a fairly high load factor. For a poor load factor, however, and especially for a plant that is expected to act during most of its life as a standby plant, economizers are not considered a good investment. Where economizers are installed it is necessary either to increase the height of smokestack or to provide induced-draft apparatus. This increases the cost of the economizer installation and must be considered when balancing interest and other fixed charges against the increased efficiency resulting from the economizers.

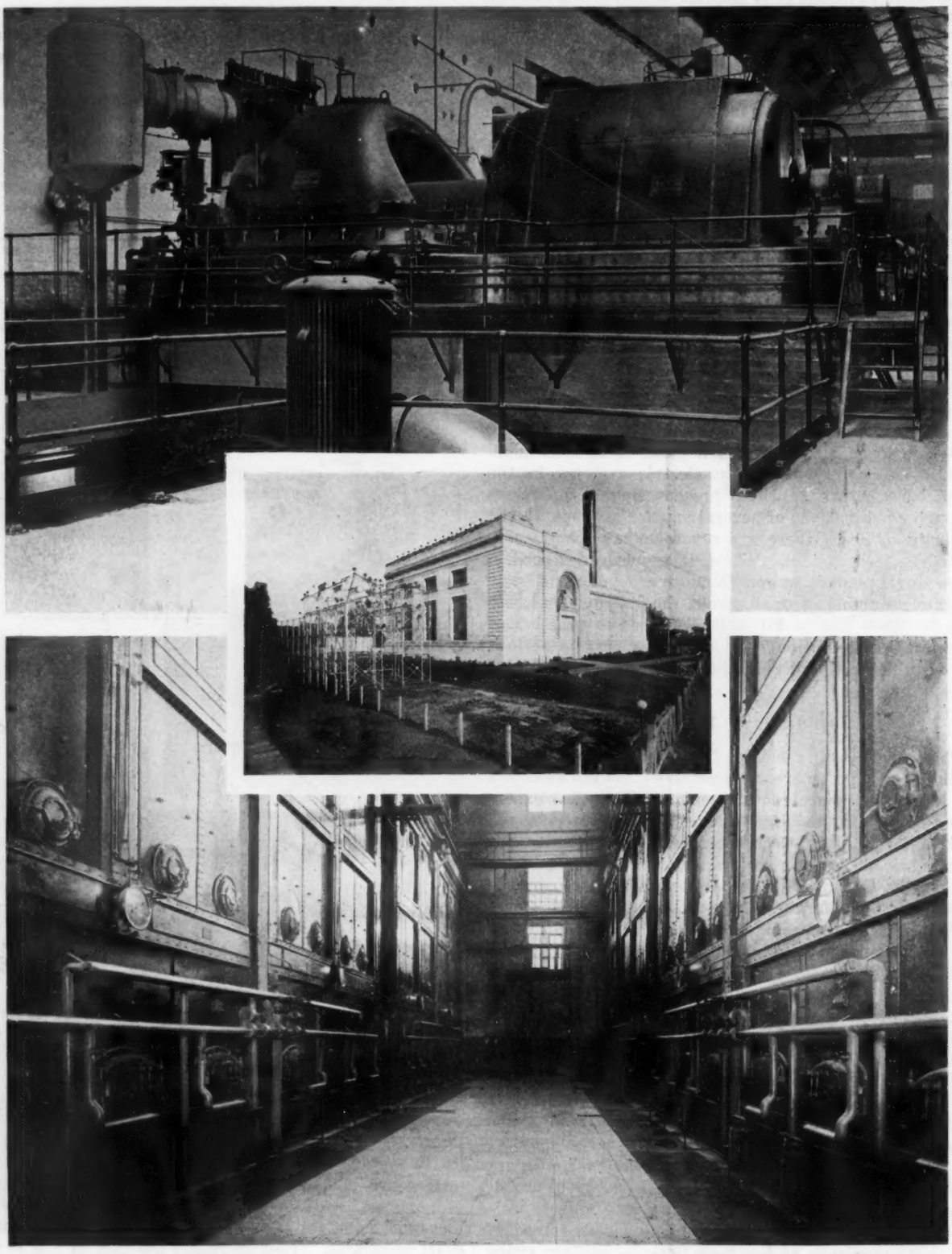


WESTERN STEAM PLANTS AND THEIR INTERESTING FEATURES

1. Seattle—Made for a ready changeover from fuel oil to coal. 2. Spokane—5,000-kw. electric heater for feedwater. 3. Portland—Plant designed for use of hog fuel. 4. Sacramento—Well-planned and attractive exterior. 5 and 6. Oakland and San Francisco—Extensive operating tests on furnace installations. 7. Bakersfield—Use of natural gas as a fuel. 8. El Centro—Use of artificial draft in chimney construction. 9. Redondo—Combined use of reciprocating engines and turbines. 10 Long Beach—Extensive use of recording instruments in maintaining economy. 11. Phœnix—Record efficiency in fuel oil consumption. 12. Ajo—Extensive use of automatic regulation.

The modern tendency in the operation of central steam stations is toward higher steam pressure and higher superheat. Theoretically in any heat engine the maxi-

Two Oil-Burning Plants of the Pacific Gas & Electric Company



A new 15,000-kw. turbo-generator in Station "A," San Francisco, is shown above. Below are four new 823-hp. oil-fired Stirling boilers. Recent tests on furnace operation at this station have done much to advance thought on this line. In the center is shown an example of attractive architecture applied to powerhouse design, the 5,000-kw. oil-burning steam-turbine station of Pacific Gas & Electric Company, Sacramento.

mum efficiency is obtained, as shown in the Carnot cycle, by having the temperature at which the heat is supplied to the working substance uniform at the highest attainable value and the temperature at which heat is withdrawn uniform similarly at the lowest attainable value. With steam the upper temperature range may be raised either by increasing the pressure or by increasing the superheat, or both. In neither case, however, is the upper temperature range uniform. Increase of pressure does, however, carry the elevated temperature through a longer part of the range than increase of superheat and thus more nearly approaches the condition for maximum efficiency with any given extreme upper limit of temperature. We should thus expect that a given extreme upper limit of temperature reached through high pressure and relatively moderate superheat would give better conditions for economy than lower pressure and higher superheat.

This may be illustrated by the following example, in which steam at 200 lb. pressure and 200 deg. Fahr. superheat is compared with steam at 300 lb. pressure and 166 deg. Fahr. superheat, both of these combinations giving actual temperature of superheated steam at 588 deg. Fahr.:

Pressure, gage, lb. per sq. in.....	200	300
Temperature saturated steam, deg. Fahr...	388	422
Degree of superheat, deg. Fahr.....	200	166
Temperature superheated steam, deg. Fahr.	588	588
Heat per lb. steam (above 32 deg.), B.t.u...	1310	1300
Heat (above 32 deg.) per lb. steam after expanding adiabatically to 1-in. absolute, B.t.u.	892	866
Heat available per lb. steam, B.t.u.....	418	434
Heat utilized at 75 per cent efficiency, B.t.u.	313	325
Moisture in exhaust steam, per cent	9.2	11.4

It will be observed from the above comparison that while the quantity of heat present in the initial steam in the two cases is practically the same, the heat utilized in the case of steam entering the engine at 300 lb. pressure is about 4 per cent more than in the case of the 200 lb. pressure steam. It will also be observed that there is more moisture in the exhaust steam in the case of 300 lb. pressure initial steam than in the case of 200 lb. initial steam. This means that there will be less work to be done by the condenser as more of the steam is already condensed. This results in a still further advantage to the higher pressure steam. On the Pacific Coast steam pressures up to 200 lb. have been used for many years, station "A" of the Pacific Gas & Electric Company, San Francisco, having been built for that pressure in 1901.

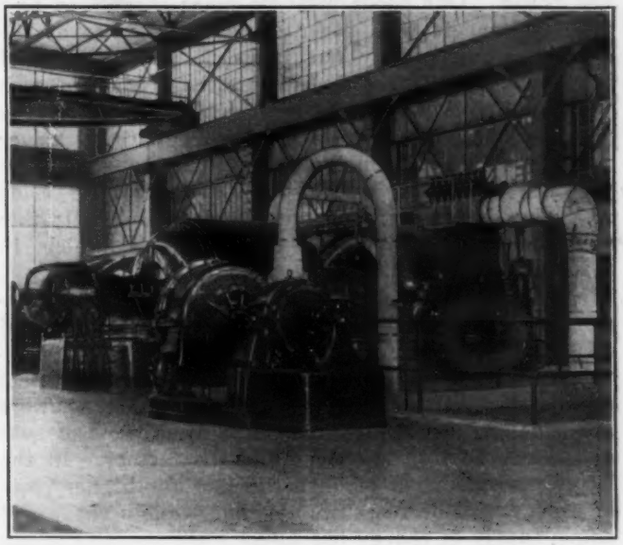
Within the last two or three years higher pressures than this have been adopted, several plants having been built for boiler pressures of 250 lb., while in the Eastern states plants are already in operation at 300 lb. pressure and pressures even as high as 590 lb. are being talked of as possibilities. The maximum limit to pressures and superheat is determined at the present time by the temperature that the materials of construction will stand. With present steels 700 deg. Fahr. is about the limit. This limit would be reached at 500 lb. pressure and 230 deg. Fahr. of superheat. One of the main advantages of higher steam pressure is the fact that the increase in cost of equipment is very small compared to the advantages obtained, since it is merely necessary to design the machinery to withstand the greater pressures.

For auxiliaries steam drive is cheaper if the exhaust steam can be used for heating purposes. Otherwise electric drive is cheaper. It may be desirable to install duplicate auxiliaries in which one set is driven by steam and the other by electric power. A system which has been used to advantage at the Connors Creek plant of the Detroit Edison Company and other stations in the East, but not yet introduced on the Pacific Coast, employs a separate auxiliary turbine and generator for supplying the auxiliaries. With heavy loads the exhaust steam from this turbine is used for heating feed water. With light loads the turbine is shut down and hence no exhaust steam is wasted.

At the present time centrifugal pumps are used in all cases except for fuel oil and lubricating pumps, where the reciprocating type is still used. Steam turbines are preferred to reciprocating engines even where slow speed is desired.

AUTOMATIC CONTROL

As economical operation of a plant is obtained by the careful watching of all details, it is a growing conviction that personal control under trained supervisors is the one way to produce high economy. This is especially true of the boiler room, and it is common practice in the best plants to employ a combustion engineer to make flue-gas analyses and to keep a continual check on the boiler efficiency. There is a tendency toward introducing automatic control into the fire room. Automatic oil-fire regulators have been placed in service in a number of plants on the Pacific Coast and increases in efficiency as high as 3 or 4 per cent are reported. Another tendency at the present time is to equip the plant with recording meters which register automatically all important elements of operation throughout the full twenty-four hours of the day. It was formerly the custom to operate boilers with no instruments except a steam gage, but it is now customary to install steam-flow meters which register the quantity of steam produced by the boiler, the quantity of steam used by the burners, and air meters which indicate the amount of air passing through the boiler settings. These instruments are of great value in assisting the combustion engineer to secure maximum efficiency from the boiler plant.



AUTOMATIC OIL REGULATION PROVED ECONOMICAL IN THIS PLANT

In this plant of the Cornelia Copper Mining Company, Ajo, Ariz., oil consumption was reduced 3 per cent to 4 per cent by extensive use of automatic fuel regulators.

Urgent Need of Super-Power Developments

Increased Industrial Production and Shortage of Power Over Large Manufacturing Districts Call for Immediate Development of Great Power Projects and Elimination of Small Steam Plants

By LIEUT.-COL. C. F. LACOMBE

THE world destroyed, burned up and exploded more wealth in the recent four years of war than in any similar previous period. The cost of the tremendous effort necessary on the part of the free nations of the world to save their institutions has been financed by promises to pay in huge amounts. These promises to pay cannot be redeemed entirely in gold—there is not enough in the coffers of the nations—they must be paid to a large extent in property and products as yet unmade. To produce the raw material necessary and to make it into salable property, products or goods requires labor, machinery and power. Our goods must be made cheaply so that we can compete with other countries in spite of the conditions imposed by our industrial requirement of higher wages. To accomplish this the product of each individual worker must be sufficient to pay the wages required profitably, for the amount of these wages must be obtained from the proceeds of the sale of the workers' product. Such production cannot be made solely by the strength or skill of the individual; this must be supplemented by mechanical aids, which, in turn, require power to drive them.

Energy is produced by the burning of fuel, the explosion of gases or the propelling force of water and appears in the form of heat, steam or electricity. Anything affecting the cost of fuel and its transportation, or the cost of making the country's water powers available and profitable, affects directly the cost of heat and power both in the home and the factory. In the latter increased cost of energy makes for higher costs of product and decreased production, while a cheap and ample supply of energy has directly the opposite effect. The cost of fuel to the consumer doubled during the four years of war by reason of the increased cost of mining, higher interest rates, higher wages and higher costs of transportation, appliances and supplies. With the increased wages of engineers and firemen, as well as the greater cost of supplies, added to the increased price of fuel, the cost of producing energy has advanced materially in every engine room throughout the country. Fortunately, during the last fifteen years, by improved processes and appliances, the amount of good coal required to produce a unit horsepower for an hour has been greatly reduced and the cost of large steam plants per unit of capacity has greatly decreased. This is true, however, only in the larger and most improved type of power plants, for in small, old or unimproved plants operating under the conditions of 1900 the high cost of the energy produced, at the present prices of fuel and labor, is startling and must very materially affect production and costs.

Growth in First Cost of Both Steam and Water-Power Plants

The decreased unit cost of steam plants over that of former years has had a decided effect on the value and utilization of water powers. The great factors in this case are the first cost of the water-power plant and the annual fixed charges on it. The cost of the labor and material to build a water-power plant has materially increased in the last four years and is comparable to the increased cost of new steam plants. In the northeastern section of the country, east of the Mississippi and north of Virginia, the water-power development which is feasible and profitable now is only a fraction of the present demand. This accentuates very strongly the necessity and value of developing every profitable water power within reach of a possible energy market, not only in order to reduce the cost of energy and increase production but to conserve fuel resources.

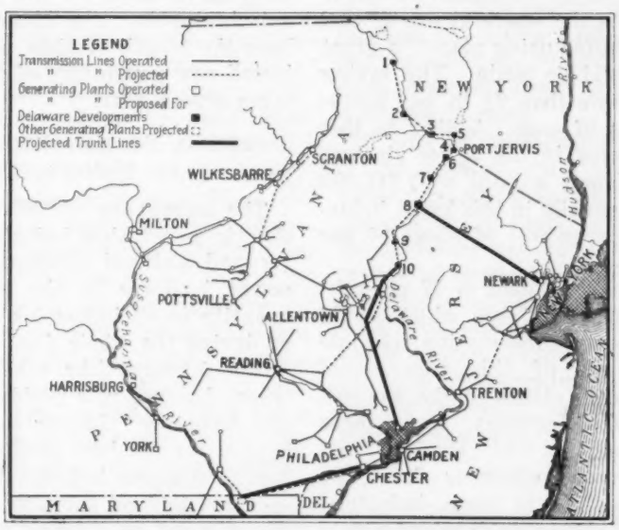
Factors Making Development Necessary

The necessity for cheaper energy and larger production is the most important reason now for these developments, but the conservation of fuel follows them closely. We have ample fuel resources in quantity for a prolonged period, although the cost will increase and the quality decrease as the most available and best deposits are exhausted; but the fact that this ample supply does exist is no excuse for wasting fuel as we are doing at the present time. We owe something to posterity, but what is more important, we owe to ourselves the duty and profit that can be derived from using our fuel so as to obtain the greatest and cheapest output of energy from it. This, in turn, aids the workman to increase his output so that the manufacturer can sell in greater quantity and at lower cost, employ more skilled labor, pay higher wages, and so complete the cycle of production and reward upon which the nation lives and thrives.

The director of the Bureau of Mines has stated that out of the total production of bituminous coal in 1917 25 per cent, or 150,000,000 tons, was being wasted by inefficient use in the boiler plants throughout the country. This waste was found most frequently in the boiler rooms of plants or factories where the production of energy was treated as incidental to the main purpose and where there was little, if any, trained supervision, technical or otherwise. These wastes strongly indicate that wherever possible energy should be supplied from a plant that manufactures energy alone and which must succeed by its economical production.

Coal is being mined and used as fuel at a tremendous rate. During 1918, under pressure, 685,000,000 tons of coal were mined in this country, or more than were mined in Germany and England together in 1913. This country possesses enormous potential quantities of coal, estimated at over three thousand billion tons, but a large portion of it is of extremely low grade. England has been mining coal for six hundred years. Now her mines are deep and the most profitable and best veins are practically worked out. The difficulties of mining have increased and her output per miner has decreased one-fifth. America must expect the same result at some future date, and the enforced consumption of this low-grade coal will increase the cost of energy production very materially.

A diagrammatic map published in the ELECTRICAL WORLD of Feb. 22, 1919, made by O. C. Merrill, chief engineer of the Forest Service, Department of Agriculture, showed the distribution of our hydraulic resources and of primary power in the United States. A study of this indicates that in the great industrial district north of Virginia and east of the Mississippi, even if all its hydraulic resources were suddenly developed, more than 20,000,000 hp. must be furnished by fuel for all time, and provision made as well for all increased demand in the future. The development of water power in this area is most important, although at most it can provide only a fraction of the energy required. All that is feasible should be developed quickly, and in the meantime the power industry should use its fuel with thrift instead of continuing the present economic waste. The advantage gained from the co-operation of great interconnected steam and hydro-electric plants, generating according to the dictates of economy and distributing their energy over great industrial fields, was demonstrated by obtaining data in 1918 from the larger generating stations in New England, New York, New Jersey, Pennsylvania, Delaware and Ohio. Including all the larger towns in New England, New York City, Buffalo, Rochester, Syracuse and other cities on the Niagara system, Cleveland, Lorain, Toledo, Pittsburgh and a number of towns near it in eastern Ohio, Philadelphia, eastern Pennsylvania towns, New Jersey, Wilmington and Baltimore, it was found that in 1918 the principal distributors of energy generated 6,605,000,000 kw.-hr. This amount was produced from coal alone and does not include that also produced by water power in New England, New York and elsewhere. The fuel necessary to produce this energy totaled 8,621,000 tons and was valued at $42,788,000. The same amount of fuel in 1915 would have cost only $21,056,000. The increased cost due to present conditions was therefore $21,731,000.



POWER SYSTEMS OF EASTERN PENNSYLVANIA INDUSTRIAL SECTION AND PROJECTED TRUNK LINES

In the industrial district described a survey showed in one center 258 small plants of about 1,000 hp. each which used over 7 lb. (3.1 kg.) of coal per unit, 2,565,000 tons annually, while the large plants throughout the whole district averaged 2.61 lb. (1.18 kg.) per unit. Similar conditions exist in each large manufacturing center, and this indicates that in the whole area small individual plants generated about the same amount of energy as the combined large ones, but on a most conservative basis used more than twice the amount of fuel and generated at more than double the cost of the large stations. It should be remembered that the cost of fuel is double what it was in 1915, and hence the cost of this waste is twice what it was at that time.

This startling and useless loss can be stopped by using instead power from large steam-turbine generating stations erected where they can obtain sufficient quantities of water for condensing purposes, as well as cheap fuel, and located with a view to efficient distribution of the energy produced.

Generating plants of this advanced economic type with an installed generator capacity of 100,000 hp. cost from $90 to $100 per horsepower, not including the secondary distribution system. Such plants would use about 1½ lb. of coal per horsepower-hour, including transmission and distribution losses. In comparison with 1½ lb. of fuel used by such a plant a small plant uses at least 3¾ lb., giving a saving in favor of the large generating station of 2¼ lb. per horsepower-hour of energy produced. The investigation indicated that the fuel consumption of the central stations from which data were obtained could be reduced to a little less than 1½ lb. per horsepower-hour if the stations were remodeled and enlarged. There are a number of potential water powers in the area under consideration upon which engineering estimates have been made. In New England 600,000 kw. is possible of development, but it is believed feasible at present to develop only about 323,000 kw. on account of unsolved problems of storage and steam auxiliaries. Such a development would save about 1,378,000 tons of coal per year. The increasing demands for energy in New England will absorb this water-power capacity in about four years, and further energy production must depend upon the use of fuel or further possible hydraulic developments requiring extensive storage works.

Further development at Niagara Falls has been limited to improvements in methods of utilizing the water and to the fraction of the water allowed by treaty but not previously used. These extensions and improvements can replace the annual use of 500,000 tons of coal in cities served by the Niagara systems. Similar extensions and improvements at hydro-electric plants near Baltimore would yield a saving of 133,000 tons of coal.

Developments on the Delaware and Susquehanna Rivers would save about 1,600,000 tons of coal now used annually in the large power plants of New Jersey, Philadelphia and Wilmington. If these power markets were interconnected, supplied with energy from these water powers to the north and the south, and this system linked with large steam plants in the anthracite region of eastern Pennsylvania, and also to the new large and economical steam stations at Philadelphia, not only could the separate sources of power be used jointly, to their best economy and consequent lower cost of production, but an ample supply of power would be available for increased production. During the war there was an acute shortage of energy supply over a large part of this territory, and a similar shortage may occur from the demand for energy for reconstruction purposes unless extensions are provided in the near future.

The economies and new developments itemized above would therefore bear two marked results. The first effect would be to decrease the fuel used by the large power plants generating and distributing energy as a business. The saving of coal would be 2,300,000 tons from increased fuel efficiency in the present steam plants remodeled and enlarged, and 3,611,000 tons from additional water power in New England, Niagara Falls, Baltimore, the Delaware and the Susquehanna.

The second effect would appear in the use which could be made of this amount of fuel and the steam machinery saved by substitution of water power. The fuel is sufficient to develop 7,881,000,000 hp.-hr. at 1½ lb. per hour. The new water power would free sufficient machinery now in use to produce 4,815,000,000 hp.-hr. of energy. If this energy were distributed by great plant systems to replace the wasteful use of coal in the smaller individual manufacturing plants, a great additional saving in fuel would be made. The saving from this source would be more than 2¼ lb. per horsepower-hour or 5,416,000 tons of coal. Adding to this the 2,300,000 tons of fuel saved in the larger stations through increased fuel efficiency, a total of 7,716,000 tons of coal would be saved annually in this great industrial district at a present average cost of about $5 per ton, or a total of $38,580,000.

This huge saving in fuel is equivalent to 12 per cent on an investment of $321,500,000, a sum which would more than accomplish the power-conservation schedule outlined. The accomplishment of this plan would require four or six large steam plants in the western Pennsylvania and eastern Ohio territory, about three large tidewater steam plants in New England and improvements yielding increased efficiency from the larger steam plants now existing in these industrial areas. The water-power developments involved would include the full development of feasible water powers in New England and northern New York, increases at Niagara, and the developments mentioned on the Delaware and Susquehanna Rivers. For ultimate success the plan must include certain interconnections between plants in a given district and the co-operation of steam and hydro plants wherever possible in order to obtain the highest general efficiency in generation.

A part of these developments is shown as an example on the accompanying map of the eastern Pennsylvania and Philadelphia districts. Apparently a stupendous task, but not so difficult as might be supposed if all those interested could be given the incentive to get together and develop the plan in each power center. Some of this work has already been started at Pittsburgh, Philadelphia and Niagara, but still more encouragement must be given to larger plans if the desired result of increasing industrial production is to be accomplished.

That the central station power industry throughout the country is the best means of producing and distributing a public supply of energy is confirmed by the great growth in the supply of energy furnished by these plants, both steam and water, in late years. It has been claimed on good authority that energy derived from these plants furnished 60 per cent of the products necessary to the successful conduct of the war. Census returns show that the output of energy of these plants throughout the country in 1907, 1912 and 1917 was, in billions of kilowatt-hours, 5.86, 11.53 and 25.43 respectively.

While these utilities operated during the war under very difficult conditions, they were the only emergency source of power in the country; that is, the only one that could be called on for sudden increases in output even to the danger point of capacity and continuity of service. These companies succeeded in responding to this demand in many cases by operating every generator without reserve for more hours a day than ever before, for the reason that machinery was practically impossible to obtain and install in time to be of service. As a matter of fact, when war was declared all the spare power capacity not already at work for the Allies was quickly appropriated in certain important sections of the country, and had the war continued there would have been a forced delay in equipment for the enlarged army as planned, for the power needed to make it was not obtainable. The measure of this delay would have been the length of time necessary to manufacture and install new generators of the large sizes, which usually takes over a year.

CENTRAL STATION BECOMES A LARGE FACTOR IN MANUFACTURING INDUSTRY

The emergency of the war proved quickly that the electric generating industry had taken another stride forward and had developed from a lighting and small power business to the supplying of energy in any quantity to all industries over many hours of the day, or during the whole day, every day in the year. This stride forward, like others the electric industry has taken, develops new problems of construction, operation and financing. Larger plants are necessary, carefully located for the best productive and distributive advantage, and larger individual machines must be made and operated to meet the new demand. Very large sums of money must be obtained to accomplish this. The new power business differs from the older lighting business as at present regulated in that it must meet competition. A manufacturer needs little protection by law from the power industry or monopoly, for he can install his own plant, whereas the small lighting consumer requires protection.

The power capacity of the electric industry must be increased largely to meet the recent and future demand for power. In doing this the industry is confronted by regulatory laws enacted in thirty-eight states after 1905. These laws established electric utility service as a monopoly, prevented uneconomic competition and caused through commissions the supervision of the issue of securities, the regulation of the rate of return on the investment and the review of the rates to be charged the public. In this manner these laws gave the securities of utilities a stability and safety as investments not previously possessed, but the rate of return was established at 6 or 8 per cent, depending on the rate of interest prevailing in their state. In other words, a fixed reward or profit was established for the electric utility business. No further incentive was provided, and all that remained to work for was the advantage accruing from large growth and a great volume of business.

FUNDAMENTAL CONDITIONS COMPLETELY CHANGED

This state continued more or less satisfactorily until the upheaval of 1914. Since then fundamental conditions have completely changed, not only as to costs of fuel and materials but also as to money. At first regarded as temporary, it is now seen that these changes

may endure for a prolonged period. This country lost less by war than any other combatant, and must do its full share of production to make up the enormous waste of the great war. This production calls for an ample supply of power, more than is now available, and the signs of this demand are unmistakable. The loss and waste in individual energy production is sharply realized. Individual manufacturing plants are requiring more energy than they can produce without increasing their own power plants at high costs and in consequence are calling for cheaper energy from central distributing plants. Sections that showed insufficient capacity during the war years of 1917 and 1918 are showing symptoms of a similar lack of capacity at the present time. The power industry can meet the demand, but requires a measure of relief in order to do so.

For the last three years at least the normal program of development and capacity has been very greatly retarded by the effects of the war. The margin of reserve capacity existing before the war has been much reduced, and the industry is not equipped to meet heavily increased demands for power. To increase the power capacity by the improved methods already described requires the investment of very large sums of money. The power industry finds it is exceedingly difficult to obtain these necessary funds, for the reason that it is not allowed to earn enough to pay the cost of money at this time in competition with industries whose earnings are not restricted. The laws regulating public utilities, otherwise good in many respects, have affected the borrowing power or credit of these utilities. They set a fixed and now insufficient reward for the work of making power by utility corporations and for transportation by railways.

These laws were made in days when supply met demand. Now it is necessary to create the supply to meet the demand, but these regulations have removed the incentive to the investor to invest money in the utilities, because he can do better with it elsewhere. Nor have the utilities the incentive to borrow the money and take the risks of construction and operation when they are allowed to earn only 6 or 8 per cent on their investment and receive no additional reward for increased effort and efficiency.

In the last three years the cost of making power has so increased that the commissions have allowed advances in rates or allowed the higher cost of fuel to be added to power bills. Without this even the permitted rate of return could not be earned. If the existing financial conditions continue over a long period without any change in the regulations governing the rate of return, there will be great difficulty in getting the cheap and ample supply of power needed during a period when the utmost industrial production is required.

An analysis of the resolution of increased rates shows that it is not the best solution in that it does not attain the best results. It merely passes the extra cost to the consumer, raises the cost and lessens the amount of production, because the high cost of product reduces sales; and, further, it encouarges waste of fuel. A much more efficient reward and incentive must be devised which will result in obtaining the funds with which to increase our supply of power, enlarge production, keep costs down and stop our senseless waste of fuel. This incentive can be provided by allowing the power industry to earn the present allowed rate of return, with necessary reserves, maintenance and replacement charges, and adding to it a fair division of the savings that could be made by the cheaper production of power through improved and enlarged power systems. A provision somewhat along this line, allowing additional returns to the railroads, has been incorporated in the railroad bill recently passed by Congress.

It is certainly just that the power industry should receive a share of the profit it enables others to derive by furnishing cheaper power than could otherwise be obtained. A fair share of the profit gained from improved processes will enable the industry to obtain money for new plants without additional cost to the public. At present neither the public nor the power companies is gaining any advantage from the existing arrangement, owing to the existence of the fixed rate of return. The public is actually penalizing itself by meeting the extra and avoidable costs. These costs exist because the industry cannot get the money to reduce them, nor would it receive a reward for doing so were this feasible.

If this situation were fully realized, the power users of the country would appeal to the commissions even more strongly than the power makers for means of increasing the supply and reducing the cost of power by providing the incentive of a just division of the profits of production. The manufacturers in a given community logically constitute the market which should absorb the securities of the power companies, for they would be the greatest beneficiaries, receiving not only the rate of return on their investment but a further reward derived from their profits on increased production at decreased cost.

Obtaining Satisfactory Graphic Meter Records

Care Must Be Exercised in Selecting Proper Meter for Any Particular Service—All Necessary Explanatory Data Should Appear on Chart

BY WALTER L. HAMILTON
Holyoke, Mass.

TO THE uninitiated, records obtained from graphic meters are often as difficult to interpret as is the method by which they are obtained. To facilitate interpreting graphic-meter records a study of meters producing them is useful. These meters are principally of types used to record such conditions as temperature, flow of liquids and gases, speed, voltage, current, power-factor, power, etc.

The charts furnish a permanent record covering the total period of test, including all important conditions of interest. These records may be used for discussion before committees or individuals at any time and have the advantage of showing results in pictorial form, which is much more readily comprehensible than is a mass of data.

In selecting curve-drawing meters for installations the character of the service to be recorded and the results desired should be carefully considered, for a little study may often save annoyance and disappointment later. Record charts may be circular in form, the circumference representing a period of time usually from twelve hours to one week. They may be oblong in shape and placed on the periphery of a cylinder, their total length representing a definite period of time. Other

charts are of the continuous-strip type with 1 in. (2.5 cm.) of their length representing one hour or fraction there-of. The continuous charts are usually found in high-grade, high-priced meters, as a more powerful clock and more complicated paper-feeding mechanism are required than in meters using circular chart. It is sometimes desirable to have charts calibrated to represent only a portion of the meter capacity. Voltmeters and frequency meters, for instance, are commonly calibrated for about 60 to 100 per cent of their capacity. This arrangement permits a wide scale over the probable variation of the service to be recorded.

Meters may be very sensitive, or damped and direct-operating, or of the relay type, adjusted for sensitive or sluggish operation. Erroneous conclusions are often obtained owing to the time lag of the curve-drawing meter. Very sensitive meters will try to record accurately every variation in the load. This gives a wide curve and for rapidly fluctuating loads is not altogether desirable. Other meters may be damped to such an extent that their record may represent more nearly average conditions.

In making special tests with portable curve-drawing meters, it is desirable to mark on each test the time in seconds required for the pen to travel across the chart without load on the meter. This may be done by holding the pen over against the top of the record and with a stop watch noting the time the pen requires to reach the bottom of the chart, or it may be determined by noting the advance in paper during the return travel of the pen, provided that high-speed paper feed is used.

When curve-drawing meters are to be permanently installed, the paper feed should be as slow as possible, as the problem of filing away their records is often found very annoying. The circular chart should be small in diameter.

Meters should be somewhat sluggish in movement, as a record of average conditions is usually desired and not peaks of momentary duration.

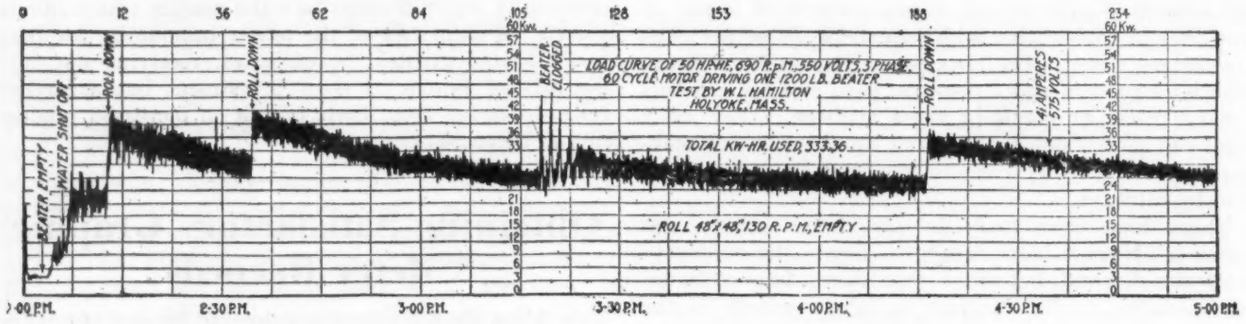
The clock forms a very important part of the meter, as the records would be of little value if the clock failed to keep proper time or stopped altogether.

Of the various installations and purposes for which curve-drawing meters may be used, the greatest value and usefulness lie in their use for portable work and for intensive study under the supervision of a competent engineer. When they are to be used for a short period of time to obtain engineering data or to investigate operating conditions the continuous-chart meter should be used, adopting sufficient paper speed to prevent the recording pen traveling more than twice over any portion of the chart. Oftentimes when slow paper feed is used the repeated travel of the pen over the same part of the chart causes ink blots and unintelligible records. For this service every precaution should be taken while obtaining records which will facilitate explaining them to persons unfamiliar with meter records. Meters using charts having rectangular co-ordinates and straight-line pen movements are best suited for this service.

While making special tests it is not only necessary to have high-grade apparatus, but it is also important that the persons making the test shall be careful observers of operating conditions and the equipment being tested. The explanation of certain parts of the records would be difficult to obtain later unless at the time the record was made the cause for each variation in load was determined. Very few data should be left to memory while making tests. The records should be carefully and profusely lettered. Too often valuable tests are obtained, but, owing to the lack of sufficient explanation, after a short period of time they become practically useless.

The accompanying illustration represents a test in which the various points of interest are well noted. As many data as possible should be placed on the original record, not kept in a notebook, for after a short period the mind will not be able to connect these data with the original record, and persons unfamiliar with the test will find it difficult to interpret. Moreover, there is the possibility of the data being lost. This record embodies several interesting points. The curve was obtained by using a wattmeter of the straight-line relay type and was damped, twelve seconds being required for the pen to cross the record without load on the meter. It represents the load on a 50-hp., three-phase, 60-cycle, 550-volt motor, driving a beater in a paper mill by means of a silent chain drive. Owing to the length of this record, which covers a period of twenty-four hours, only a short section is shown. The meter producing this curve was of 100-volt, 5-amp. capacity, polyphase, and for this test 600-volt to 100-volt potential and 50-amp. to 5-amp. current transformers were used. In obtaining curves care should be used in selecting the proper size of current transformers for the tests in order that the curve shall be well up on the chart and yet not go off the chart at any time; thus any variations in the load will be recorded with greater accuracy.

In this case paper without time or capacity markings was used, and the meter pen was arranged to use Higgins' black drawing ink. This permits making blueprints from the original, which are easier to interpret than the original records.



OBSERVE COMPLETE ANNOTATION ON CHART FOR TEST OF MOTOR-DRIVEN BEATER IN PAPER MILL

Electric Service in the American Home

Detailed Study of Reports from More Than 5,000 Central Stations Indicates That 33,008,500 Americans, or 30.7 Per Cent of the People, Live in Electrically Lighted Homes—Houses Wired Number 6,291,160, Farm-Lighting Plants About 340,000

THE home is the center of civilization from which flows the attributes which make or unmake a nation. In the council of nations the importance of a people can be judged from the enlightenment to be found in the homes of that people. The tendency toward retrogression is always in full force, and the advancement of a people as a whole can be accomplished only under the most favorable conditions. Americans are now living in what may be termed the "electrical age," for the field of usefulness of electrical energy is being more rapidly developed in American homes than in the homes of any other people. In an endeavor to ascertain the extent to which the American homes are now wired for electric service and the proportion of the people within the present reach of central-station distribution systems the ELECTRICAL WORLD has made a detailed study based upon recent reports from more than 5,000 electrical generating companies submitted in connection with the compilation of parts of the country, indicated that 58 per cent of the houses in these cities were wired. In cities ranging from 5,000 to 10,000 the percentage was 54, and thirty-two cities with a population of more than 10,000 or less than 20,000 showed that 60 per cent of the houses were wired. The Society for Electrical Development also issued a summary of a similar survey as of Jan. 1, 1918. This valuable contribution, entitled "Customers versus Population," gave the population reached and the residences served by the larger central stations. The statistical department of the Western Electric Company made a detailed study of the situation as of Jan. 1, 1918, estimating that 5,000,000 houses were wired at that time. However, there seems to be no record of any prior estimate by states based upon direct reports of a majority of the operating companies of the country, and it is believed that the survey and information reported herein will be of service to the industry.

The value of electric service for the home is now

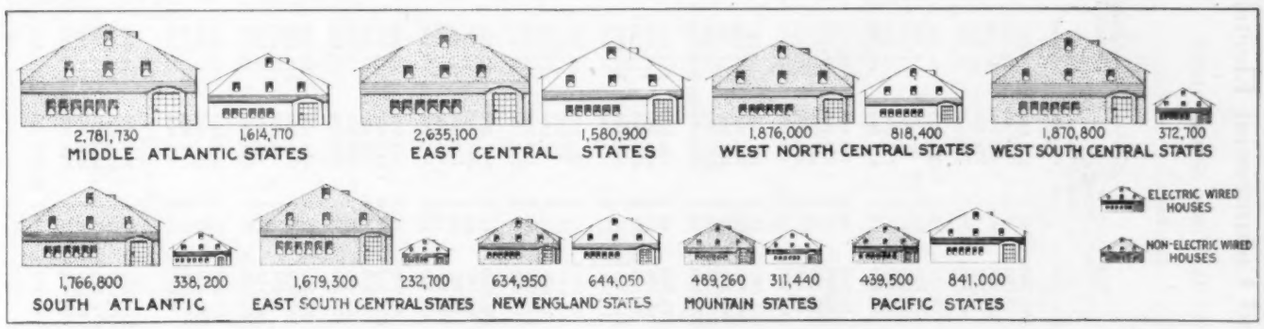


FIG. 1—PROPORTIONATE NUMBER OF ELECTRICALLY WIRED AND NON-ELECTRICALLY WIRED HOUSES IN VARIOUS SECTIONS OF THE UNITED STATES

the 1920 edition of the "McGraw Central Station Directory and Data Book." This study has been very carefully made from information covering the details of electric service in more than 10,000 cities and towns and the surrounding country districts. The summarized results are presented in Table I.

The central stations of the country cover at the present time territory populated by 62,023,400 people, or about 57.3 per cent of the total population of the United States. Of this population within reach of central-station service, about 55.8 per cent live in electrically lighted houses. Of the total population of the country, however, only 33,008,500, or 30.7 per cent, are enjoying the benefits of electricity in their homes. There is a total of 6,291,160 houses wired for electricity, of which 48.0 per cent are in the Central States. California ranks first in number of houses wired per capita with 79 per cent, while Mississippi ranks lowest with only 8.4 per cent. The total number of stores wired was determined to be 1,459,169.

Other estimates of this nature have been made in the last few years. In 1915 it was estimated that not more than 10 per cent of the residences of the country were connected with central stations. The same year the National Electric Light Association conducted a survey in which returns from more than 100 cities of a population of 5,000 or less, taken at random from all well recognized, and it is estimated by capable authorities that about 98 per cent of the houses being built in cities and towns are wired for electricity. It is most important, therefore, that the architect and contractor should consider carefully the proper location and proper number of outlets for lighting fixtures, sufficient appliance outlets for the numerous labor-saving devices now used for heating, cooking and power, as well as the proper location of the switch control. To obtain the maximum use of small household apparatus every inducement to their operation should be given, and slipshod building plans which do not consider the conveniences of the occupants should be discouraged. In anticipation of a large consumption of electrical energy by electrically operated household appliances, a separate wiring system for these devices should be installed in new houses which will permit them to be connected to a separate meter. This enables the central station to adjust rate schedules when the demand merits a lower rate and to encourage the use of electrical appliances on an attractive basis.

As in all lines of industry central stations and distributing companies have been cutting down operating expenses to a minimum and making a minimum number of extensions. This enforced economy has resulted in the elimination of line extensions which under normal conditions would be considered essential to the proper

Table I—Present Status of Domestic and Commercial Electric Service by States and Sections

(Electrical World Survey, 1920)

State	Population of State (Estimated from 1910 Census) (2)	Population Reached by Central Stations (3)	Per Cent of Total Populat'n Reached by Central Stations (4)	Persons per Dwelling (5)	Dwellings in Territory Covered by Central Stations—Total Number (6)	Electric Wired—Total Number (7)	Electric Wired—Per Cent of Total (8)	Not Electric Wired—Total Number (9)	Not Electric Wired—Per Cent of Total (10)	Dwellings in States—Total Number (11)	Electric Wired—Total Number (12)	Electric Wired—Per Cent of Total (13)	Not Electric Wired—Total Number (14)	Not Electric Wired—Per Cent of Total (15)	Population Living in Electric Lighted Houses—Total Number (16)	Per Cent of Total (17)	Stores Wired (18)	Farm-Lighting Plants—Total Number of Farms (1910 Census) (19)	Farms Served by Farm Plants (20)	Per Cent of Total Farms (21)
Alabama	2,446,000	632,000	25.9	4.8	131,600	52,400	39.8	79,200	60.2	510,000	52,400	10.3	457,600	89.7	252,000	10.3	8,550	262,901	2,500	1.0
Arizona	286,000	144,000	50.3	4.5	32,000	12,920	40.4	19,080	59.6	63,500	12,920	20.4	50,580	79.6	58,200	20.4	4,980	9,227	590	6.4
Arkansas	1,836,000	436,000	23.8	4.8	90,800	48,200	53.1	42,600	46.9	383,000	48,200	12.6	334,800	87.4	221,000	12.6	13,020	214,678	3,260	1.5
California	3,267,000	2,827,000	86.5	4.6	613,000	561,000	91.4	52,000	8.6	710,000	561,000	79.0	149,000	21.0	2,580,000	79.0	76,700	88,197	2,410	2.7
Colorado	1,058,000	700,000	66.3	4.3	162,800	99,100	61.0	63,700	39.0	246,000	99,100	40.3	146,900	59.7	427,000	40.3	19,050	46,170	2,690	5.8
Connecticut	1,320,000	1,160,000	88.0	6.1	190,000	119,830	63.0	70,170	37.0	216,000	119,830	55.5	96,170	44.5	731,000	55.5	33,200	26,815	1,820	6.8
Delaware	220,000	141,000	64.0	4.7	30,000	9,270	30.9	20,730	69.1	46,800	9,270	19.8	37,530	80.2	43,600	19.8	3,130	10,836	310	2.9
Dist. of Columbia	437,000	430,000	98.3	5.7	75,400	21,800	28.9	53,600	71.1	76,700	21,800	28.4	54,900	71.6	124,000	28.4	2,980	217	0	0
Florida	976,000	447,000	45.8	4.5	99,400	67,000	67.3	32,400	32.7	217,000	67,000	30.9	150,000	69.1	302,000	30.9	8,500	50,016	2,510	5.0
Georgia	3,001,000	832,000	27.7	4.9	170,000	80,700	47.5	89,300	52.5	612,000	80,700	13.2	531,300	86.8	396,000	13.2	22,500	291,027	7,240	2.5
Idaho	489,000	246,000	50.3	4.5	54,700	38,160	69.7	16,540	30.3	107,600	38,160	35.4	69,400	64.6	172,000	35.4	9,775	30,807	1,800	5.8
Illinois	6,454,000	5,150,000	79.8	5.6	919,000	626,000	68.1	293,000	31.9	1,153,000	626,000	54.3	527,000	45.7	3,505,000	54.3	174,700	251,872	15,300	6.1
Indiana	2,885,000	1,700,000	58.9	4.3	395,000	197,700	50.0	197,300	50.0	671,000	197,700	29.4	473,300	70.6	850,000	29.4	32,450	215,485	11,250	5.2
Iowa	2,224,000	792,000	35.6	4.5	176,000	107,400	61.0	68,600	39.0	494,000	107,400	21.8	386,600	78.2	482,000	21.8	22,650	217,044	18,700	8.6
Kansas	1,911,000	930,000	48.7	4.4	211,200	145,700	69.6	65,500	30.4	434,000	145,700	33.6	288,300	66.4	640,000	33.6	21,790	177,841	8,940	5.1
Kentucky	2,433,000	754,000	31.0	4.9	153,800	90,200	58.7	63,600	41.3	497,000	90,200	18.2	406,800	81.8	442,000	18.2	25,330	259,185	5,330	2.1
Louisiana	1,931,000	676,000	35.0	5.0	139,200	44,800	29.5	90,400	70.5	386,500	44,800	11.6	341,700	88.4	224,000	11.6	9,670	120,546	2,670	2.2
Maine	790,000	639,000	80.8	4.7	139,900	77,700	57.2	58,200	42.8	168,000	77,700	46.2	90,300	53.8	365,000	46.2	22,880	60,016	1,480	3.3
Maryland	1,403,000	826,000	58.9	5.1	162,000	50,000	30.9	112,000	69.1	275,000	50,000	18.2	225,000	81.8	255,000	18.2	16,900	48,923	2,850	5.8
Massachusetts	4,126,000	4,030,000	97.8	6.6	612,000	338,500	55.3	273,500	44.7	625,000	338,500	54.2	286,500	45.8	2,232,000	54.2	49,250	36,917	880	2.4
Michigan	3,199,000	1,945,000	60.7	4.5	432,000	257,000	59.5	175,000	40.5	710,000	257,000	36.2	453,000	63.8	1,156,000	36.2	38,300	206,960	6,770	3.3
Minnesota	2,399,000	1,393,000	58.2	5.5	253,200	188,000	74.3	65,200	25.7	435,500	188,000	43.2	247,500	56.8	1,034,000	43.2	39,800	156,137	7,320	4.7
Mississippi	2,042,000	347,000	16.9	4.8	72,300	35,600	49.2	36,700	50.8	426,000	35,600	8.4	390,400	91.6	168,000	8.4	7,980	274,382	2,490	0.9
Missouri	3,479,000	2,080,000	59.8	4.9	424,500	207,000	48.8	217,500	51.2	709,000	207,000	29.2	502,000	70.8	1,014,000	29.2	66,000	277,244	6,460	2.3
Montana	508,000	311,000	61.3	4.5	69,200	51,300	74.2	17,900	25.8	113,000	51,300	45.4	61,700	54.6	231,000	45.4	7,830	26,214	1,610	6.2
Nebraska	1,318,000	568,000	43.2	4.6	123,500	88,700	67.3	34,800	32.7	286,000	88,700	31.0	197,300	69.0	407,000	31.0	19,620	129,678	10,580	8.1
Nevada	122,000	66,300	54.3	3.6	18,420	14,480	78.6	3,940	21.4	33,900	14,480	42.7	19,420	57.3	52,200	42.7	1,427	2,689	200	7.5
New Hampshire	449,000	422,000	93.8	4.8	87,900	29,900	34.0	58,000	66.0	93,600	29,900	31.9	63,700	68.1	143,000	31.9	6,260	27,053	320	1.2
New Jersey	3,189,000	2,707,000	84.8	6.2	435,000	218,000	50.2	217,000	49.8	514,000	218,000	42.4	296,000	57.6	1,350,000	42.4	24,070	33,487	1,360	4.1
New Mexico	439,000	104,200	23.7	4.3	24,300	13,300	54.8	11,000	45.2	102,100	13,300	13.0	88,800	87.0	57,200	13.0	1,450	35,676	230	0.6
New York	10,954,000	8,620,700	78.7	7.7	784,000	440,000	54.6	344,000	45.4	997,000	440,000	44.2	557,000	55.8	4,835,000	44.2	209,000	215,597	8,530	4.0
North Carolina	2,518,000	539,000	21.4	5.1	105,700	49,200	31.3	56,500	68.7	493,000	49,200	10.0	443,800	90.0	250,500	10.0	9,330	253,725	6,560	2.6
North Dakota	834,000	283,000	33.9	4.9	57,750	42,300	73.3	15,400	26.7	170,000	42,300	24.9	127,700	75.1	207,000	24.9	12,080	74,360	32,340	43.0
Ohio	5,375,000	3,550,000	66.1	4.7	755,000	362,500	48.0	392,500	52.0	1,143,000	362,500	31.7	780,500	68.3	1,705,000	31.7	70,000	272,045	30,200	11.0
Oklahoma	2,522,000	602,000	23.9	4.8	125,300	60,900	48.6	64,400	51.4	526,000	60,900	11.6	465,100	88.4	293,000	11.6	13,730	190,192	4,250	2.2
Oregon	931,000	580,000	62.3	4.6	126,000	80,000	63.5	46,000	36.5	202,500	80,000	39.5	122,500	60.5	368,000	39.5	10,060	45,502	400	0.9
Pennsylvania	9,025,000	6,220,000	68.8	5.1	1,218,000	365,500	30.0	852,500	70.0	1,770,000	365,500	20.6	1,404,500	79.4	1,863,000	20.6	135,500	219,295	36,400	16.6
Rhode Island	656,000	643,000	98.0	6.8	94,600	41,800	44.2	52,800	55.8	96,400	41,800	43.4	54,600	56.6	285,000	43.4	12,720	5,292	100	1.9
South Carolina	1,690,000	357,000	21.1	5.0	71,400	51,000	71.4	20,400	28.6	338,000	51,000	15.1	287,000	84.9	255,000	15.1	8,360	176,434	4,320	2.5
South Dakota	765,000	269,000	35.2	4.6	58,400	39,300	67.3	18,700	32.7	166,000	39,300	23.7	126,700	76.3	181,000	23.7	9,240	77,644	30,530	39.0
Tennessee	2,348,000	621,000	26.4	4.9	126,800	54,500	43.0	72,300	57.0	479,000	54,500	11.4	424,500	88.3	267,000	11.4	9,060	246,012	2,890	1.2
Texas	4,742,000	1,758,000	37.1	5.0	351,700	218,800	62.3	132,900	37.7	948,000	218,800	23.0	729,200	77.0	1,095,000	23.0	33,900	417,770	32,000	7.7
Utah	470,000	377,000	80.2	5.1	73,900	68,600	92.8	5,300	7.2	92,200	68,600	74.4	23,600	25.6	350,000	74.4	8,110	21,676	340	1.6
Vermont	368,000	254,000	69.1	4.6	55,230	36,320	65.8	18,910	34.2	80,000	36,320	45.3	43,680	54.7	167,000	49.2	11,620	32,709	490	1.5
Virginia	2,268,000	667,000	29.4	5.1	130,800	90,300	69.1	40,500	30.9	445,000	90,300	20.3	354,700	79.7	461,000	20.3	10,140	184,018	6,700	3.7
Washington	1,765,000	1,280,000	72.5	4.8	266,700	200,000	74.9	66,700	25.1	368,000	200,000	54.3	168,000	45.7	960,000	54.3	49,500	56,192	2,980	5.3
West Virginia	1,483,000	390,000	26.3	5.1	76,400	37,200	48.7	39,200	51.3	291,000	37,200	12.8	253,800	87.2	190,000	12.8	6,270	96,685	2,860	3.0
Wisconsin	2,598,000	1,471,000	56.7	5.0	294,500	147,700	50.2	146,800	49.8	519,000	147,700	28.4	371,300	71.6	738,000	28.4	47,000	177,127	7,440	4.2
Wyoming	199,000	104,900	52.7	4.7	22,300	13,580	60.8	8,720	39.2	42,400	13,580	32.0	28,820	68.0	63,800	32.0	2,807	10,987	800	7.3
Sections																				
New England	7,709,000	7,148,000	92.7	6.0	1,175,630	644,050	54.8	531,580	45.2	1,266,000	644,050	50.9	634,950	49.7	3,903,000	50.9	135,930	188,802	5,090	2.7
Atlantic	37,164,000	22,177,200	59.6	5.7	3,358,100	1,479,970	44.0	1,878,130	56.0	6,075,500	1,497,970	24.3	4,595,500	75.7	8,905,000	24.0	456,680	1,580,260	79,640	5.0
Central	53,741,000	25,957,600	48.3	4.8	5,287,600	3,014,700	56.9	2,272,900	43.1	11,046,000	3,014,700	27.3	8,031,300	72.6	14,881,000	27.3	674,870	4,219,103	241,220	5.7
Mountain	3,571,000	2,053,400	57.5	4.5	457,620	311,440	67.9	146,180	32.1	800,700	311,440	39.5	489,260	61.1	1,411,500	39.5	55,429	183,446	8,260	4.5
Pacific	5,963,000	4,687,200	78.6	4.7	1,005,700	841,000	84.1	164,700	15.9	1,280,500	841,000	65.6	439,500	34.2	3,908,000	65.6	136,260	189,891	5,790	3.0
United States	108,148,000	62,023,400	57.3	5.2	11,284,650	6,291,160	55.8	4,993,490	44.2	20,481,700	6,291,160	30.7	14,190,540	69.3	33,008,500	30.7	1,459,169	6,362,502	340,000	5.3

growth of a company. In some cases the station and line capacity will not permit large additional load until new equipment is installed. Such companies are not encouraging new residence connections but are concentrating on the increased use of small household apparatus by their present customers. The use of household electrical devices creates essentially an off-peak load.

Many cities possessing the necessary station capacity have undertaken extensive house-wiring campaigns with complete success. In Elmira, N. Y., for instance, the number of houses wired was raised from 6,000 to 7,500 in one year, more than three-quarters of the houses in

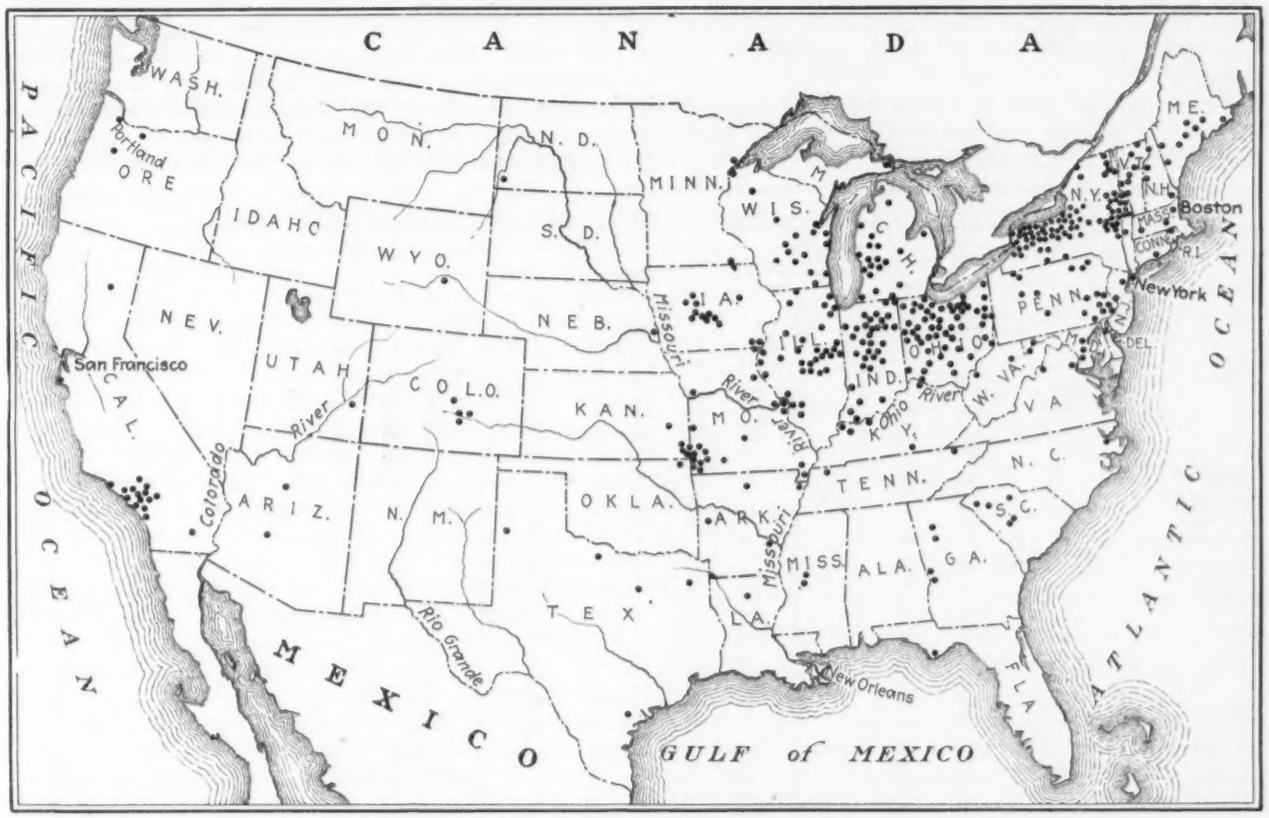


FIG. 2—MAP SHOWING LOCATION OF CENTRAL-STATION SERVICE AT FREQUENCIES OTHER THAN 60-CYCLE

that city being now electrically wired. There is, however, little or no direct relation between the increase in number of new houses wired and increase in revenue. This was clearly demonstrated in Worcester, Mass., in 1917, when the number of wired houses increased 21.7 per cent while the revenue increased 32.4 per cent. It is also quite possible that a selling campaign will increase the revenue by the sale of small household appliances, while additional houses wired may raise the revenue without the sale of small household apparatus. Campaigns for wiring new houses and selling appliances conducted together make up the ideal combination.

The diagrams in Fig. 1 indicate the saturation of wired houses in the various sections of the country. The illustrations do not, however, indicate the location of the field of active operation for new wiring. The East South Central States show the largest ratio between wired and unwired houses, but the North Central, Middle Atlantic and New England States present the most fruitful field for future operations.

The present year holds forth large gains in wired houses in districts where there is ample generating capacity or where additional installations are contemplated. The new building in 1919 was estimated at five billion dollars, of which about 40 per cent was for residences, giving about 200,000 new houses. The building operations in 1920 are estimated at six billion dollars, of which about two and one-half billion dollars will be spent on about 240,000 residences. Such construction offers a tremendous field for domestic lighting as well as a large growth in the use of small household electrical apparatus, and to this field must be added the old houses, a large quantity of which will undoubtedly be wired during the year. There is, however, a time lag of from six to nine months after building permits are issued before the effect of new house installations is shown from central-station records, so that building undertaken in the fall of the year will not appreciably affect the central-station output of the present year.

The American farmer, while happy and satisfied with his surroundings, still has a secret yearning, with reason, for some of the comforts which are to be found in the town and city dwelling. He is becoming convinced that electricity offers him light, running water, labor-saving devices and sanitation at small cost. Thus the farm furnishes a field of no small proportions for electrical development in the future. Farmers as a whole are financially able to install electrical appliances in their houses and barns, but they have not as yet been fully educated into the advantages of electric service.

Three ways are open to the farmer to get electric service: (1) Direct from a central-station transmission line; (2) by a small private plant run by a gasoline engine; (3) by a small private plant run by water power. In order that an idea might be obtained of the present development of the farm-plant industry extensive correspondence was undertaken in connection with the present survey. From various sources actual data and estimates have been obtained covering the distribution of farm plants of various makes throughout the

country. While the estimates varied over wide ranges, the consensus of opinion is that there were about 340,000 farm plants in the United States at the present time, and that from 100,000 to 110,000 plants will be sold during 1920.

The figures given in Table I showing the number of farm-lighting plants at present installed in the various states must not be considered as exact, but are based on reports received from various manufacturing concerns and are believed to represent correctly the proportionate distribution of farm plants throughout the country. While there are about 6,400,000 farms in the nation, yet only about two-thirds of them can be considered prospects for farm-lighting plants, on account of their small size, their unproductiveness or the personality of the farmer.

Farm lighting opens up a field involving hundreds of millions of dollars. At an average rate of $500 for each plant, the farm-lighting business of 1920 will amount to $50,000,000 or $55,000,000. This does not include accessories and appliances. The installation of lighting plants on the farm will mean the installation of sanitary plumbing fixtures, water-supply equipment and up-to-date heating apparatus. The servant problem is especially serious on the farm, and the farmer's wife will find a way to obtain various household labor-saving devices once the electric service to operate them is available.

One of the primary causes of slow progress in introducing complete electric service in the homes of some sections of the country is the existence of odd frequencies and odd voltages of central-station service; that is residence service at other than 60 cycles and 110 volts. Most small household devices are designed for standard ratings. Fig. 2 shows the location of the central stations of the country where the service to residences is at a frequency other than 60 cycles. Numerous plants of this type are located in northern New

TABLE II—CENTRAL STATION FUEL AND GENERATOR STATISTICS

State	Number of Central Stations Jan. 1, 1919	Voltage				Frequency			Fuel Used										
		110 Volts, A.C. (No. of Stations)	Other than 110 Volts (No. of Stations)	D. C. (No. of Stations)	Undetermined (No Report)	60 Cycles (No. of Stations)	Other than 60 Cycles (No. of Stations)	Undetermined (No Report)	Water Power	Coal	Internal Combustion Engine (Gasoline Distillate)	Coal and Wood	Coal and Water Power	Oil	Wood	Oil and Coal	Oil and Internal Combustion Engine	Miscellaneous	Undetermined (No Report)
Alabama	82	54	11	4	13	65	0	13	1	34	....	4	....	....	11	....	....	....	32
Arizona	39	19	5	1	14	24	2	14	1	5	....	....	....	11	....	....	....	2	22
Arkansas	104	57	11	13	23	64	4	23	1	28	4	7	....	6	9	....	....	....	47
California	130	97	28	2	5	86	39	5	10	1	3	....	....	10	....	....	....	....	106
Colorado	89	45	28	7	9	69	4	9	4	12	2	....	1	1	....	....	....	....	69
Connecticut	51	30	17	5	9	46	1	9	5	12	....	1	1	1	....	....	....	....	31
Delaware	20	12	2	2	4	13	1	4	....	6	....	....	..	....	....	....	....	....	14
Dist. of Columbia	2	1	0	0	1	0	1	1	....	1	....	....	....	....	....	....	....	....	1
Florida	110	60	12	1	37	71	1	37	....	21	3	4	....	27	10	....	....	1	43
Georgia	198	87	32	4	75	114	5	75	8	47	....	10	1	2	14	....	1	....	116
Idaho	60	28	21	3	8	49	0	8	6	....	1	2	....	....	1	....	....	....	50
Illinois	365	263	53	39	30	282	34	30	5	163	10	....	1	19	....	2	....	2	163
Indiana	257	140	38	24	55	146	32	55	2	105	4	2	1	6	....	2	....	2	133
Iowa	300	201	55	34	10	240	16	10	18	118	8	....	1	26	....	4	1	2	122
Kansas	335	164	27	23	121	186	5	121	2	54	25	....	1	86	....	7	7	2	151
Kentucky	130	57	12	20	41	64	5	41	....	60	4	1	....	20	3	1	....	....	41
Louisiana	82	33	10	8	31	42	1	31	....	7	6	2	....	23	8	4	....	2	30
Maine	111	46	14	1	50	51	9	50	29	11	1	1	1	....	4	1	....	1	62
Maryland	59	27	9	3	20	33	3	20	....	20	3	....	....	....	....	....	....	3	33
Massachusetts	261	91	37	4	129	125	3	129	5	45	1	....	....	1	....	1	....	2	207
Michigan	258	106	66	17	69	152	20	69	22	88	2	4	6	10	4	1	1	4	116
Minnesota	279	130	17	52	80	145	2	80	6	92	6	6	1	25	5	5	3	5	125
Mississippi	110	40	15	7	48	72	3	48	....	44	2	5	....	11	5	2	....	....	194
Missouri	263	137	29	32	65	147	19	66	1	103	2	5	....	41	3	13	5	1	89
Montana	71	33	14	6	18	46	1	18	11	15	2	....	1	12	....	....	1	1	28
Nebraska	251	119	18	61	53	130	1	53	10	39	9	....	....	65	....	10	15	10	73
Nevada	30	9	1	0	20	8	0	20	2	1	....	....	....	....	....	....	....	2	25
New Hampshire	65	28	20	1	15	44	6	15	12	12	....	....	4	....	2	....	1	4	30
New Jersey	74	45	15	7	7	57	9	7	3	34	....	....	....	6	....	1	....	3	27
New Mexico	34	19	5	0	20	22	1	20	3	11	....	....	....	7	....	1	....	1	11
New York	389	201	93	11	84	217	99	84	60	110	6	1	4	6	....	1	1	6	194
North Carolina	148	68	33	2	45	98	1	45	14	45	2	8	....	2	7	....	....	1	69
North Dakota	133	41	7	51	34	44	1	34	....	27	11	....	....	42	....	1	2	17	32
Ohio	331	159	103	28	41	204	59	41	....	144	0	....	....	6	....	....	....	38	143
Oklahoma	174	109	18	3	44	125	1	44	....	53	39	1	....	23	1	5	5	4	43
Oregon	70	34	36	0	0	71	6	0	25	....	....	1	....	4	17	....	....	3	20
Pennsylvania	272	184	68	20	0	234	19	0	26	115	....	1	2	....	....	....	....	15	114
Rhode Island	26	8	10	0	8	15	1	8	....	2	....	....	....	....	....	1	....	....	23
South Carolina	93	48	23	0	22	63	7	22	2	32	2	3	....	1	3	....	1	....	51
South Dakota	126	53	11	33	29	61	0	29	2	22	12	....	3	21	1	4	14	5	42
Tennessee	111	53	11	6	41	61	2	41	7	48	1	5	4	1	....	....	1	....	44
Texas	300	200	40	25	35	232	6	35	3	36	17	5	....	103	7	12	13	27	77
Utah	73	26	47	0	0	45	1	0	17	2	....	....	....	....	....	....	....	....	54
Vermont	68	25	31	1	11	45	7	11	15	14	....	....	2	....	....	....	....	1	36
Virginia	101	41	28	10	22	63	2	22	13	38	1	2	1	4	....	....	....	1	41
Washington	150	98	42	6	6	132	0	6	20	10	1	1	....	8	7	....	....	2	101
West Virginia	75	40	7	5	23	41	4	23	2	21	4	....	....	....	....	....	....	17	31
Wisconsin	327	161	77	67	22	202	17	22	53	87	....	2	3	24	14	1	2	21	120
Wyoming	36	22	7	2	5	23	1	5	3	13	2	....	....	7	....	....	....	....	11
Sections																			
New England	582	228	129	12	213	326	27	218	66	96	2	2	8	2	6	3	1	8	388
Atlantic	1,541	814	322	65	340	1,004	152	340	128	490	21	29	8	48	34	2	3	48	732
Central	4,318	2,277	629	547	865	2,664	228	865	133	1,372	162	49	21	558	81	74	69	143	1,656
Mountain	432	201	128	19	84	286	10	84	47	59	7	2	1	38	1	1	1	4	271
Pacific	350	229	106	8	343	289	45	343	55	11	4	2	....	12	24	....	....	5	237
United States	7,223	3,749	1,314	651	1,509	4,569	462	1,509	429	2,028	196	84	38	658	146	80	74	208	3,284

York, Illinois, Indiana and Michigan, and California possesses a considerable number. Many of these are old plants of small rating, operated under conditions that do not warrant new or rehabilitated installations. As transmission networks are extended these plants will gradually be eliminated or taken over and their service standardized. Table II gives the location of plants with odd voltages.

As a matter of information the kinds of fuel burned by the various central stations are included in Table II. The relation between the use of coal and oil as a fuel is very clearly indicated. These statistics are as of Jan. 1, 1919, and it is probable that later data will show many changes.

Industrial Tractors Serve to Move Loads Economically

Replace from Three to Ten Men and Show Operating Economy of from 1.1 Kw.-hr. to 3.8 Kw.-hr. per Ton-Mile

A RECENT study of the operation and maintenance of industrial tractors used in Chicago by manufacturers and warehouses of several kinds showed that the owners consider them satisfactory and in some cases indispensable. In these industrial plants the tractors have each replaced from three to ten laborers, which at the present time the managers think is a great advantage. The survey uncovered the fact that there is a regrettable lack of accurate cost keeping in connection with electric industrial tractor and truck operation. Out of ten companies interviewed only two had anything like complete records of tractor performance. Practically all users, however, gave favorable opinions and were willing to estimate the admitted extent of the saving in labor which their tractor or truck equipment afforded. Some of these opinions and estimates are recorded in this article, and the data from the two companies which kept definite records are given in tabular form.

Sears, Roebuck & Company have seven tractors at their main building, of the size shown in the table. These are used for hauling wooden trailers in trains of five to twenty-four. They handle all kinds of general merchandise, each load weighing from 600 lb. to 2,000 lb. (242 kg. to 907 kg.). They run over concrete floors, over brick and asphalt paving and up one grade of 4 per cent. Not more than twelve trailers are pulled up this grade. Definite measurements were made on the routes by two of these tractors, the average length of haul being 200 yd. (182 m.). They are loaded at each end of the trip, never running with empty trailers. Two men are used with each tractor, one operator and one man to hook trailers. The tractors work about eight hours a day and are charged by a motor-generator set for seven and one-half hours each night. The Edison batteries have never given any serious trouble.

One length of concrete floor which was worn badly by the tractors and trailers was covered with asphalt about 1.5 in. (3.7 cm.) deep. In two years of heavy hauling this asphalt has shown very little effect of wear, while concrete under the same conditions has cracked and developed holes. However, slightly more power is required to pull a load on the asphalt.

This work at the Sears, Roebuck & Company plant was formerly done by hand, one man handling one trailer. It would not be possible, it is said, to handle the present amount of hauling by the old method on account of limited space in the hauling aisles.

Another concern which has kept records of its tractor operation is the Chicago warehouse of the Minneapolis, St. Paul & Sault Ste. Marie Railroad, which has two 135-amp.-hr. tractors. These are used for pushing steel cars on rails 60 yd. (54 m.) in either direction to or from the warehouse elevators. These cars hold an average load of 2,500 lb. (1,133 kg.), and the two tractors handle from 375 tons to 400 tons of freight per day of ten hours to twelve hours. Each tractor hauls loaded cars one day and empty cars the next to equalize the duty cycle. The charging is done at night. The batteries are "Exides," and a new set has recently replaced the original set, which ran for four years with no trouble. The complete data on the operation of these tractors and those of Sears, Roebuck & Company are given in the accompanying table.

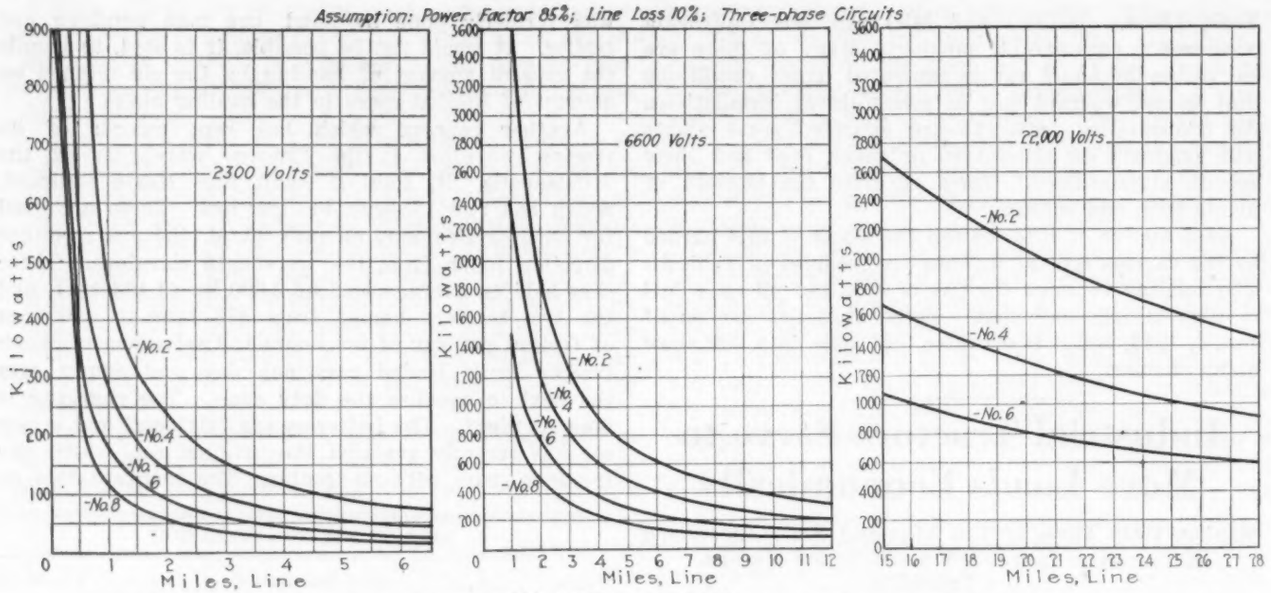
DATA ON TRACTOR OPERATION

Company	Sears, Roebuck & Co.	M., St. P. & S. St. M Warehouse.
No. of tractors	Four 300-amp.-hr. Mercury One 450-amp.-hr. Buda Two 600-amp.-hr. Mercury	Two 135-amp.-hr. Lakewood
How hauled	On wooden trailers 6 in. to 24 in. train	Steel cars, pushed
Roadway	Concrete floor, asphalt floor, brick pavement	Steel rail
Average distance of haul	One grade of 4 per cent. 200 yd. and return, loaded both ways	60 yd.
Material hauled	General merchandise	Heavy freight
Load per trip	2 to 12 tons	2 to 2½ tons
Amount per day per tractor	30 to 100 tons	185 to 200 tons
Ton miles per day per tractor	7 to 25	6 to 7
Kw.-hr. per day per tractor	27	10 to 11
Kw.-hr. per ton-mile	3.8 to 1.1	1.7
Men saved per tractor	4 to 10	5

Two other concerns which did not have definite records did have interesting and valuable comments on their tractor operation. One of these, the Kellogg Switchboard & Supply Company, has three tractors which are used with small trailers. Two of these are run on a regular schedule on a round trip about the plant. These make a distance of about 18 miles (29 km.) per day. They pick up loads of small telephone parts aggregating from 1 ton to 2 tons and transfer them from one department to another. The third truck is used for all jobs which cannot be taken care of by the "schedule" trucks. About thirty men are replaced by these three trucks. The practice of operating two of these trucks on definite schedules while the third does odd-job work is thought to be responsible for the high record of mileage and the large amount of work which the trucks do.

The Goodman Manufacturing Company, Chicago, has two 225-amp.-hr. trucks. These are equipped with an elevator platform, which is used extensively for handling the heavy motors and other machinery made in this plant. The loads handled are from 2 tons to 3 tons. Two trucks are often used under the same load to haul as much as 6 tons. The trucks operate satisfactorily on a grade of more than 8 per cent, which is encountered in this plant.

In none of the plants visited had the trucks or tractors failed to convince their owners that they were effecting a saving in labor.



FIGS. 1, 2 AND 3—RATING OF 2,300, 6,600 AND 22,000-VOLT LINES OF DIFFERENT LENGTHS

Approximate Ratings of Three-Phase Lines

APPROXIMATE ratings of three-phase transmission lines at various voltages and with different sizes of conductors can be had almost at a glance from the accompanying curves. In fact, the curves represent three qualities—distance, load and wire size—any of which can be scaled off when the other two are known. The calculations for the curves were all made on the basis of 85 per cent power factor and 10 per cent loss, this being judged an average condition. A. Evans, assistant engineer of the Arkansas Light & Power Company, Pine Bluff, Ark., who worked up the graphs, has stated that for calculations where high accuracy is not required these plates have proved quite useful. In preparing the material it was the aim to cover all of the more common sorts of lines on which estimates might be required. This decision placed the very practical limits on the distances and wire sizes used for the various voltages. For instance, Fig. 1 covers a rather complete set of conditions for 2,300-volt lines up to 6 miles (9 km.) long. Beyond this distance it is generally not good practice to use 2,300 volts. It should be noted that the figures of distance given are for miles of line, not miles of wire. The wire sizes are Nos. 8, 6, 4 and 2.

Similarly Fig. 2 covers 6,600-volt lines from 1 mile (1.6 km.) to 12 miles (19 km.) long using wire sizes Nos. 8, 6, 4 and 2. Fig. 3 covers 22,000-volt calculations for lines from 15 miles (24 km.) to 29 miles (46 km.) long using Nos. 6, 4 and 2 copper wire. Thirty-three-thousand-volt lines being the more common and covering a wider range of applications in the Central West have been given more detailed treatment than the others. Fig. 4 covers this class of construction for distances from 30 miles (48 km.) to 56 miles (90 km.) and for the following wire sizes: Nos. 4, 2, 0, 2/0, 3/0 and 4/0. This gives a range of line ratings from 1,000 kw. to 9,000 kw. For distances of from 60 miles (96 km.) to 86 miles (136 km.) and for loads between 5,000 kw. and 20,000 kw. Fig. 5 covers problems on 66,000-volt lines.

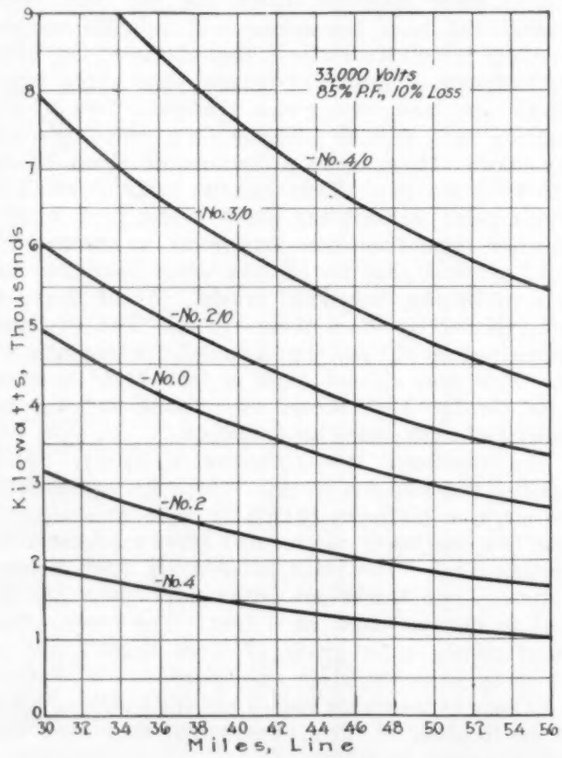


FIG. 4—EFFECT OF LENGTH ON RATING OF 33,000-VOLT LINES

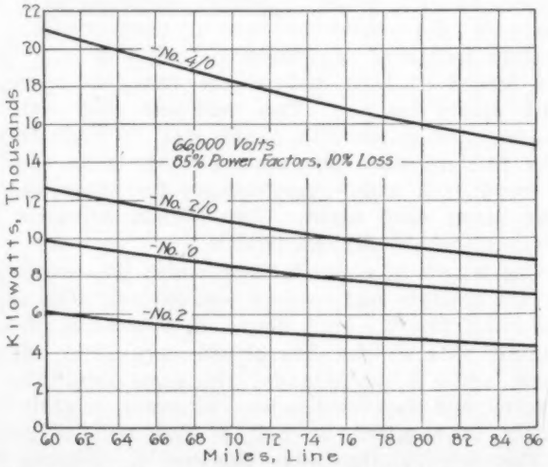


FIG. 5—RATING OF VARIOUS-LENGTH 66,000-VOLT LINES

Readers' Views and Comments

Specialization in Colleges

To the Editor of the ELECTRICAL WORLD:

SIR: I was very glad to see the decided stand taken by the ELECTRICAL WORLD, in the issue of April 24, in an editorial on "The Danger of Specialization in Colleges." As an employer of technically educated men, I agree absolutely with you in your stand on this matter. It is quite true that a broadly educated college graduate is not so immediately valuable to a company, but his value after a period of service is immeasurably greater. I think that employers who discuss this matter of immediate value of college graduates lose track of the fact that even in the practical, unskilled labor field a man is not of full value until he has been in an organization for some time. In fact, the evidence of this is shown in cost of labor turnover and the instruction of new labor.

W. D. A. PEASLEE,
Electrical Engineer.

Jeffery-Dewitt Insulator Company, Huntington, W. Va.

Pulverized Coal for Steam Generation

To the Editor of the ELECTRICAL WORLD:

SIR: In regard to the results obtained with powdered fuel in Milwaukee, as outlined in the article by John Anderson on page 589 of the March 13 issue of the ELECTRICAL WORLD, the writer believes it is fundamentally wrong to take coal and bring it to the most expensive form imaginable (powder) and still burn it in its raw state, *i.e.*, with all its hydro-carbons. A more rational procedure, affording a much more fertile field of research, is to extract some or all of the by-products, leaving coke and gas for fuel. Ultimately we must come to some such process in this country, and until that time it will be difficult to find a complete analysis of figures that will show anything but a loss for powdered fuel as compared with stoker firing.

The ash carried out by the chimney gases is a serious matter. It is reported as forming 82.8 per cent of the ash content of the coal. This is an item that should not be lightly passed. It is not sufficient to state simply that it is "apparently carried a long distance" or that "no deposit could be noticed in the street." Some accurate way of measuring this discharge should be found before definite statements concerning it are made.

In figuring the cost of coal preparation only the equivalent fuel cost was charged, and that at 1.5 lb. (680 gr.) of coal per kilowatt-hour. This comes to 17,826 B.t.u. per kilowatt-hour. Few if any stations can assume such economy as this. The correct figure for cost of energy should include all items—coal, labor, capital charges, in fact everything that goes to make up the ultimate cost of a kilowatt-hour at the point of consumption. The author of the paper is misleading himself by using only partial costs for fuel preparation.

The cement industry has used powdered coal for twenty years and no doubt has many more data on the subject than steam producers. Such plants, with established figures on cost of pulverizing coal, find that it costs in excess of $1 per ton (900 kg.) to prepare the coal. If complete costs were figured for the Milwaukee installation, the cost of preparation would probably approach this figure and more than offset the alleged saving.

The type of stoker with which the comparison is made has a 7.7 per cent difference between the gross and net efficiency. This is due to the type of stoker selected for the comparison. This type of stoker has auxiliaries costly to operate, reducing the gross or apparent efficiency to a net figure below that which can be obtained with other stokers. With chain grates, for example, the net efficiency when operating at any such ratings as shown in this report is in excess of 76 per cent. Such a figure shows 5 per cent in favor of stoker firing over pulverized fuel.

From the author's presentation of the subject, the writer believes therefore, first, that the ash nuisance is unsolved; second, in order to present even a slight saving in favor of pulverized coal it is necessary to: (a) use low-moisture coal; (b) omit interest and depreciation on the additional investment; (c) omit a large part of the cost of preparing the fuel; (d) compare with underfeed stokers having low net efficiencies due to auxiliaries expensive to operate.

Correcting these items, the showing is all in favor of stoker firing.

T. A. MARSH,
Chief Engineer Green Engineering Company.

East Chicago, Ind.

Government Control of Monopoly

To the Editor of the ELECTRICAL WORLD:

SIR: The proper attitude of government toward monopoly is one of the fundamental problems of modern life and one on which public opinion ranges all the way from the views voiced by the easy-going exponents of *laisser faire* to the theories of socialists and communists. Most citizens hold ideas somewhere between the extremes and, so far from thinking private monopoly necessarily a thing either to ignore or to abhor, adhere to the Rooseveltian doctrine of "good trusts and bad trusts." It has been said by a well-qualified thinker along these lines that monopoly produced by unfair methods of competition is bad and should be prevented, while monopoly produced by the highest human efficiency is good and should be encouraged.

This is an attractive program, but is it a practicable one? Who is going unerringly to separate the sheep from the goats? What infallible judge will discriminate between methods that are fair and methods that are not? Moreover, is it wise to lose sight of the real line of demarcation between monopolies—that which separates the natural from the artificial? Artificial monopolies, though any abuses of which they are guilty should, of course, be subject to governmental correction, will sooner or later, be they good or bad, fall to pieces from their own weight and competition will again ensue. Natural monopolies, in which class public utilities fall, must recognize that their franchises render them primarily the servants of the people and that over them the people's government holds always the whip of taxation, which can be made destructive. So to order themselves that, while a fair profit shall be theirs, no clamor for the whip to fall shall arise is the problem that confronts them.

OBSERVER.

New York, N. Y.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

High Pressure on Extra Gage Indicates Turbine Trouble

ANY trouble in a steam turbine affecting its efficiency may be detected by means of a steam gage placed between the governor valve and the first set of nozzles. This gage should be connected when the turbine is installed so as to obtain records of the pressure while the turbine efficiency is high. Records of steam pressure at the throttle, the kilowatt load and the vacuum should also be kept.

Since the economy of a turbine varies approximately in inverse proportion to the absolute pressure shown by the gage mentioned, a reading which is high compared with the records taken when the unit is new indicates trouble and warns that an investigation should be made. When it is noticed that economy is falling off the cause should be sought. The condenser system should be inspected for lack of vacuum. The buckets of the turbine may have been damaged by scale and cuttings from steam pipes or core sand in the castings.

To prevent this trouble a strainer should be put in the strain line at installation. Another possible trouble is partial clogging of nozzles or buckets with deposited material. Regular inspection of the turbine will tend to forestall most of these troubles before they appear.

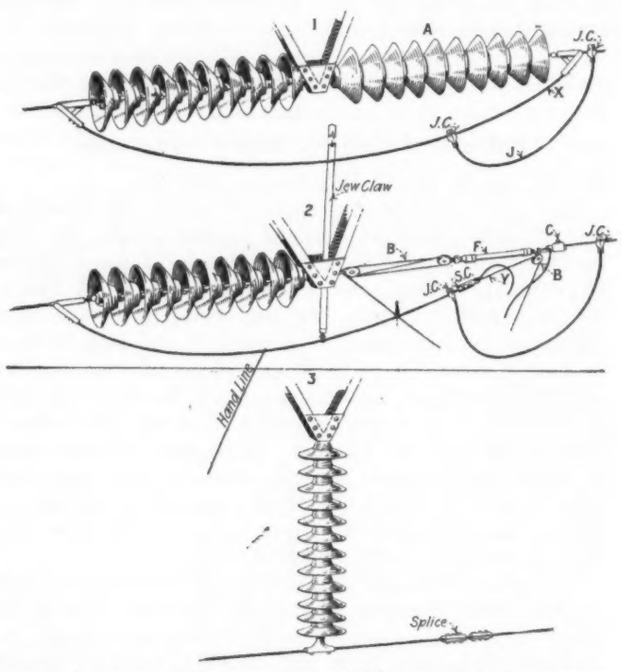
Ridgway, Pa. THOMAS HALL.

Dead-Ends on Towers Changed to Suspension on Live 110-Kv. Line

TO AVOID the rapid insulator depreciation which was occurring on a 110,000-volt transmission line of the Georgia Railway & Power Company, Atlanta, the dead-end construction shown at (1) in the illustration for 500 towers was changed to the suspension installation shown at (3). This operation was performed while the line was alive, only twenty-one minutes being taken in some instances to accomplish the change on each phase. In making the change a splice had to be made in the line so that its slack would be absorbed. The following procedure for making this splice was devised by T. F. Johnson, Jr., general electrical superintendent of the company:

A jumper (*J* in Fig. 1) is attached to the line by means of Johnson clamps, after which a wedge "come-along" (*C* in Fig. 2) is attached to the line by means of the same stick used for the clamp. Through a clevis in this "come-along" the wooden strain member *F*, called a "fuzz stick," is hooked. The double block *B* holds this stick to the cross-arm. After taking up tension on this block the string of insulators *A* is removed. To pull the slack out of the loop in the wire a rope passed through a single sheave block *B*-1, hooked to the "come-along," is used to pull on the clamp *SC*, which has been bolted to the wire by a special stick. When this slack is removed the line is cut at *X* by means of a hack saw mounted on a switch handle. While the line is being cut it is kept from swinging by means of a handline (Fig. 2) from the ground and by a tool known as a "jew claw," which is a stick having a steel hook which screws in or out of a brass head by rotating the stick when the hook is placed over the line.

After the line is cut the clamp *SC* is pulled up by the rope until the ends of the line overlap, and these ends are spliced by means of two three-bolt clamps. These clamps are lifted up to the wire by a stick which has spring steel jaws which fit a nut of the clamp. In order to force the wires into the clamp a turn of rope is taken around them, and by pulling the rope the lines are



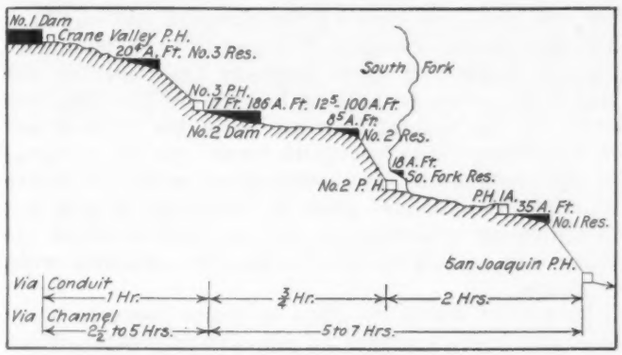
METHOD USED TO CHANGE LIVE 110,000-VOLT LINE FROM DEAD-ENDS TO SUSPENSION IN TWENTY-ONE MINUTES

squeezed together and into the clamp. Then the bolts are tightened by socket wrenches at the ends of insulating sticks.

When the splice is completed the jumper *J* and the block *B*-1 and its clamp are removed. Then by means of another "fuzz stick" and block the line is suspended from the cross-arm while the "come-along" *C* and the blocks *B* are transferred to the other side of the arm for removing the other string of insulators. After these are removed the vertical string is installed and the line is fastened in the line clamp by means of a live-line socket wrench. When the line is fast the "fuzz stick" which was supporting the line may be removed and the job is completed.

Difficulties of Dispatching Loads of Several Plants on Same River

SINCE many rivers in the Pacific Coast region are developed at several points to take advantage of the entire fall, it is sometimes quite difficult to hold a load if one of the plants should fail. Although the water can be passed around the plant, it takes time to reach the next lower plant. Moreover, it may be allowed to run either through its natural channel or through shorter artificial channels or conduits. All this makes a complicated job for the load dispatcher, who handles all water flow as well as electric load. An example of



TRAVEL OF WATER IS MUCH SLOWER BY NATURAL CHANNEL THAN BY TUNNEL

such a water-power system is shown in the accompanying diagram of the Crane Valley plants of the San Joaquin (Cal.) Power & Light Company. On this system the water may be bypassed around any plant or around any conduit, thus allowing operation of the remaining plants in case of failure of either a power house, a ditch or a penstock. It will be noted, however, that the time taken for water to flow through the natural channels is two and a half to five times that required through the conduits. Therefore in case of a conduit failure, unless there is some stored water in the reservoirs below, the plants may have to drop part of their load until the water diverted through the river channel shall reach them. This trouble is one of the reasons which are necessitating the development of storage lakes even at the lower elevations of the river.

E. J. CRAWFORD,
Assistant Superintendent.
San Joaquin Light & Power Corporation,
Fresno, Cal.

Maintenance of Demand Meters

A SCHEDULE of tests and inspections for the printometer demand meters of the Yonkers (N. Y.) Electric Light & Power Company includes (1) an acceptance test, (2) an installation test, (3) periodic inspections, (4) periodic service tests, and (5) a laboratory test after removal. The acceptance test made in the laboratory constitutes a very thorough inspection of the meter and the clock and a three-hour preliminary run for making adjustments, followed by a two weeks' run at a fair average load.

After installation a three-hour test is run, with the customer's load on the meter if possible. The results are compared with the watt-hour meter readings, and a complete analysis is made of the printed record with respect to its accuracy during particular intervals and during the whole time of the test. Coincidently, a three-hour accuracy test of the clock is made. To catch any trouble that may develop while the meter is on the customer's premises, it is inspected twice a week when the tape is removed. A careful and full report of each inspection is handed in to the office by the inspector. Furthermore, a periodic service test is made on the demand meter in the same manner as tests are made on the watt-hour meter used in conjunction with it.

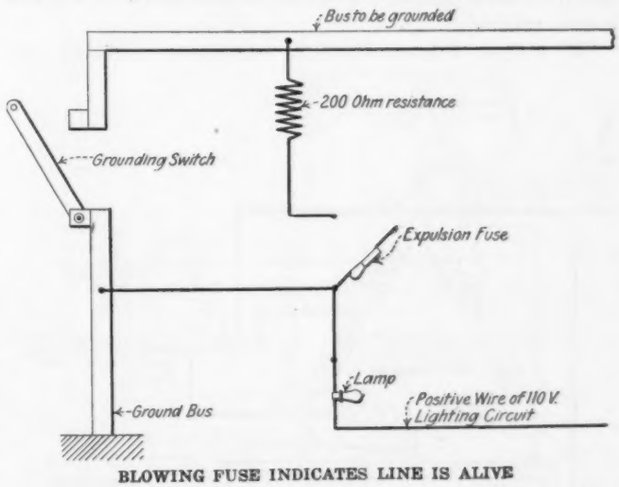
After removal of the meter from service, in order that any inaccuracies which it may have developed may be corrected before it is placed in stock, a laboratory test is made of the same character as the acceptance test.

E. E. HILL,
Yonkers, N. Y. Assistant Superintendent
Meter Department.

Permanent Station Buses for Grounding and Testing

TO ELIMINATE the unsafe practice of trailing cables through a station and of making temporary ground or test connections, the Philadelphia Electric Company makes use of permanently installed buses. These buses, which run the length of the feeder terminal compartment, may be used for grounding the feeders or for connecting them with the test set in the station. Each conductor of the feeders entering the station terminates at the middle point of a double-throw switch, the upper position connecting the feeder to its station conductor and the lower to this test bus.

In order that a live bus or feeder may not be connected to a ground bus, the following test is employed: A double-throw knife switch carrying a small-capacity expulsion fuse in its blade is mounted as shown in the accompanying diagram, with the middle point of the switch connected to the ground bus. The fuse is first tested by throwing down the switch to a clip which places it in series with a test lamp across the lighting circuit. The burning of this lamp indicates fuse integrity. Then to determine if the bus is alive the blade is swung up to the clip connected with the bus. A resist-



BLOWING FUSE INDICATES LINE IS ALIVE

ance of about 200 ohms is inserted between this clip and the bus to limit the current to a value that can be safely ruptured by the fuse. If the fuse blows, the bus is alive, and if not, the bus may be safely grounded.

WALTER C. WAGNER,
Philadelphia, Pa. Assistant Chief Engineer.

Supplying Light and Power in an Emergency

ON ACCOUNT of the rapid growth of the load at an amusement park it became necessary for the electric service company to feed both the lighting and power load from the same bank of transformers, this being done as follows: Transformers with 220-volt secondaries were joined in delta and three-phase motors connected therewith in the ordinary manner. The lighting load was served from each phase of the delta connection, it being balanced thereon as accurately as possible. In order to use 110-volt lamps it was necessary to tap each leg at its center and thus make a three-wire, 110-220 volt system. While the neutrals of three-wire, 220-volt lighting circuits should be grounded it is impossible to ground all of them with the delta transformer connection because a difference of potential exists between mid-phase points. However, one neutral is grounded, this arrangement giving more protection than no grounding at all. The power load is measured by three-phase meters, while each of the three lighting circuits contained single-phase meters connected as shown. The meters and transformers are installed at a pole-type out-door substation, the transformers being mounted on a platform and the meters below in a sheet-metal cabinet.

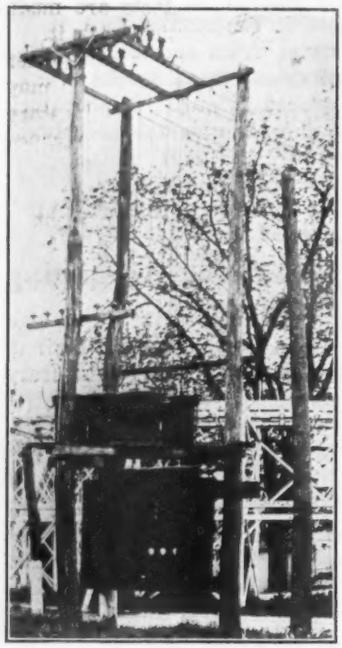


FIG. 1—TRANSFORMERS AND STEEL SERVICE BOX MOUNTED ON THREE POLES

Of course this method of supplying lighting and power load may not be the best that could be obtained, but it served its purpose and obviated the complete revamping of circuits which otherwise would have been necessary.

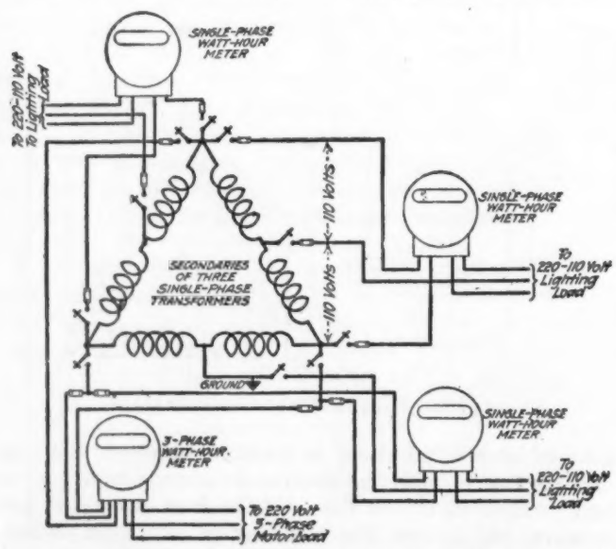


FIG. 2—SCHEMATIC DIAGRAM SHOWING METHOD OF SERVING SMALL POWER AND LARGE LIGHTING LOAD

Pulverized Coal Halves Cost of Banking Boilers

STRICTLY speaking, there is no such thing as a banked boiler when it is fired with pulverized coal. However, the same effect can be obtained very simply and with a coal consumption of about one-half that required with underfeed stokers. To cut out a boiler using pulverized fuel it is only necessary to shut off the coal feed and close all the dampers and auxiliary air inlets to the furnace. By doing this the Milwaukee Electric Railway & Light Company has found by test that a boiler can be held up to pressure for about ten hours by the radiant heat stored in the furnace and boiler setting. The loss which occurs can be compared to the banking loss in a stoker-fired boiler. It is the heat which is radiated from the boiler and setting and is equivalent in amount to that required to reheat the boiler and setting to the temperature attained when steaming.

In a plant where the ratio of boiler hours to boiler steaming hours averages 43 per cent or greater, which corresponds to an average daily plant load factor of 67 per cent, the saving resulting from the use of pulverized fuel is worth considering. Assuming 0.2 lb. (90 gr.) of coal consumed per banked boiler-horsepower-hour, in a plant equipped with underfeed stokers, this loss amounts to about 1.5 per cent. In a pulverized coal-burning plant this loss should easily be reduced to one-half of this amount, resulting in a net saving of 0.7 per cent on this one item alone.

PAUL W. THOMPSON,
Technical Engineer of Power Plant.
Detroit Edison Company,
Detroit, Mich.

Factors Essential to Good Line Construction

A SAFE job of line construction or repairing can nearly always be depended upon to render continuous and satisfactory service. Solid foundations are essential to good line construction, and this means that holes must never be skimped and that poles must be properly aligned and tamped, tamped, tamped. The old rule "Three good tampers and one shoveler" should still be followed if the best results are desired. An insufficient number of guy wires will soon cause a line to become unsightly and dangerous. This results in criticism from the public and frequent attention from the repair men. The objection of property owners sometimes makes it difficult to place guys, but neat work and the aid of city officials can overcome such obstacles.

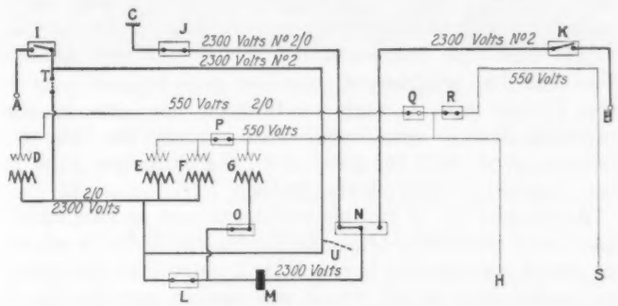
Wires which are left in contact with trees and boughs will have to come down sooner or later, so all trees should be carefully trimmed. Flexible brackets, tree molding and other devices should be used to safeguard wires through trees only when it is impossible to trim. Such devices are better than nothing, but they are not to be compared with a good clearance. These are the recommendations made by G. J. Oglebay of the Interstate Public Service Company, Bedford, Ind.

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Flexible Distribution System Proves Economical

IN A FLEXIBLE distribution system of the Simplex Wire & Cable and Simplex Electric Heating companies energy may be received from any one of the three 2,300-volt service lines shown in the accompanying single-line diagram. The factories of these companies, extending over several blocks, are furnished with



SYSTEM THAT MAY BE FED FROM ANY ONE OF THREE SOURCES

Key to single line diagram: *A*—2,300-volt service from manhole. *B*—2,300-volt service from manhole. *C*—2,300-volt service from overhead line. *D, E, F*—Three banks of three 100-kva. transformers. *G*—Bank of three 10-kva. transformers. *HS*—550-volt shop feeder lines. *I, J, K, L, N, O, P, Q, R*—Oil switches. *M*—Metering equipment. *T, U*—Jumper connections.

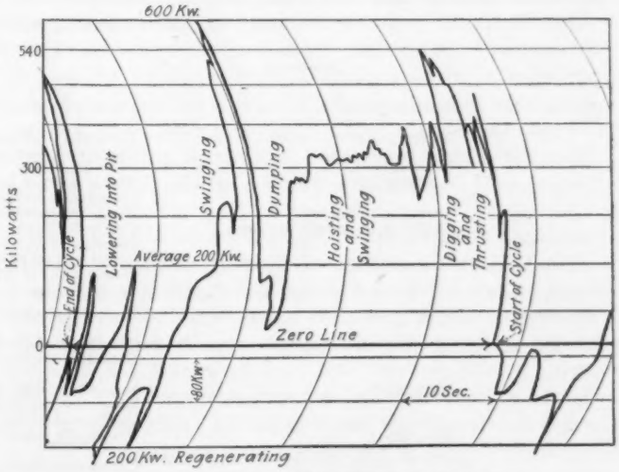
energy at 2,300 volts by the Cambridge (Mass.) Electric Light Company through one overhead line *C* and two underground lines *A* and *B*. Normally but one primary main is utilized, feeding from *C* through the oil-switch *J* and thence to the principal substation, where switch *N* is installed. *B* and *C* form sources of alternative feeding, *N* being a double-throw switch at which an emergency connection *U* may be made by jumper in case it is desired to feed from *A*.

Four banks of transformers are provided, banks *D*, *E* and *F* being rated at 300 kva. each and bank *G* at 30 kva. Local distribution within the plants is at 550 volts, three-phase. The local lighting service is obtained through 550/110-volt transformers. Transformer bank *G* is used chiefly in supplying energy outside regular working hours, thus saving the increased core losses of the larger transformers. This bank is controlled by oil switch *O*, banks *D*, *E* and *F* being controlled by oil switch *L*. Whenever these larger banks are cut out of service by the primary oil switch *L*, it is the practice to open also switch *P*. Transformer bank *D* is located at a distribution center about 625 ft. (187 m.) from banks *E*, *F* and *G*, and under normal conditions the 2,300-volt feeder from switch *I* to switch *N* is used in parallel with the 2,300-volt connection from switch *L* to bank *D*. This requires opening switch *I* in order not to short-circuit the metering installation *M*. Should it be desired to feed from *A*, the 2,300-volt connection to bank *D* is opened at *T*, the jumped connection is made at *U* to *N* and the line beyond *U* opened. In the 550-volt feeding system the various oil switches enable the northerly and southerly factory groups to be sectionalized and isolated as desired.

This installation virtually provides a through set of 2,300-volt and 550-volt buses, with a centrally located metering installation and sectionalizing switches and alternative feeds affording extremely reliable service. The value of three sources of supply has been demonstrated by experience, the third source in one instance enabling the plants to be maintained in full operation where cable and line trouble on the other feeders would have cut off service for twenty-four hours. The location of the transformer banks away from the ends of the system reduced the size of copper required and also cut down the energy losses, as compared with terminal feeding.

Large Electric Shovel Saves Time of Two Men

COMPARED with a steam shovel, the large electric shovel the load curve of which is shown here eliminates the services of two men—the fireman and the coal passer. It is estimated besides that 3 lb. to 5 lb. (1.3 kg. to 2.3 kg.) of coal is required by the steam shovel for 0.7 kw.-hr. to 0.8 kw.-hr. needed for the electric shovel. The greater results possible with the electric shovel, however, are mainly due to the few shutdowns for repairs. The electric machine is also more desirable where the feed water is bad and when cold weather



OPERATING CYCLE OF ELECTRIC SHOVEL

Shovel has 90-ft. boom, 5-yd. dipper, and is loading car 65-ft. above bottom of pit.

causes frozen pipe lines and boilers. No time is wasted in raising steam when starting. This amount of energy mentioned before, 0.8 kw.-hr., was required in the electric shovel in question per yard of material raised to

cars 65 ft. (20 m.) above the bottom of the pit. The total input to this shovel, which has a 90-ft. (28-m.) boom and a 5-cu.yd. (3.8-cu.m.) dipper, is shown here. Beginning at the right of the curve, where positive readings start, the dipper starts digging at the bottom of the pit. As a rule when the dipper starts digging the thrust motor is also on the line and the input is irregular on account of variations in hardness of the bank. When the dipper is full the swing motor is thrown on while hoisting and thrusting continue. After dumping, the dipper is raised to clear the car. This action and accelerating the swing motors cause the short high peak of about 600 kw., which, incidentally, does not occur in stripping work. After this peak, swinging requires small input, then the dipper is lowered and regenerates power, causing the negative readings. This completes the cycle, which averages fifty seconds.

In stripping, the time runs as low as thirty seconds per cycle, and the input with smaller shovels is from 0.1 kw.-hr. to 0.3 kw.-hr. per yard, depending on the hardness of the material. Dippers with a capacity of 8 yards (6 cu.m.) are made, and since the tests shown here this shovel has been operating one of that size.

In the shovel described here two heavy-duty wound-rotor induction motors of 200 hp. are used for the hoist, because the flywheel effect is less than that of one large motor and because this class of motor is not made in sufficiently large sizes. The swing motor and the thrust motor are each of about 125 hp. capacity.

Milwaukee, Wis. P. S. STEVENS.

Commutator Troubles, Their Cause and Remedies

POOR commutation, as evidenced by glowing and pitted brushes, sparking and darkened commutator, is frequently caused by wrong brush position and a wrong type of brush. In the accompanying table the visible effects of a number of commutator troubles are shown together with the causes of the trouble and the remedies. One of the most puzzling causes of sparking, as mentioned in the table, is electrical unbalance of a machine which has no equalizer rings. This unbalance occurs if the armature is not exactly centered in the field, or it may be caused by blow holes in the frame or by shorted field coils. The effect is to cause local current to flow through the bus rings between brushes.

There are two ways to test for this trouble—*i.e.*, by separately exciting and by self-exciting the machine. For both the bus rings are removed and the machine is driven as a generator. In the first method, in which the field is separately excited, the voltage between all adjacent studs is measured. If it shows high on one side of the armature the machine is unbalanced.

In the second method the machine is run with only two adjacent brushes down. The voltage is measured between these brushes, and this procedure is carried entirely around the commutator. In passing from one pair of brushes to the next at least two sets of brushes of opposite polarity must be down at all times to avoid opening the field circuit when raising a brush, as this would burn the commutator and brush. For making this test the switchboard voltmeter may be used. As in the former test, a high reading on one side of the machine denotes unbalance. The remedy for this unbalance is to shift the fields until the armature runs in the magnetic center of the motor.

Another cause of trouble which appears as ring firing and even unsolders tails and burns out coils is short-circuited commutator bars. This trouble may be caused by carbonizing of oil which has soaked into the mica. To remedy this the mica should be dug out and a filler put in its place. A good filler may be made from two parts of powdered mica and one part of plaster of paris mixed with shellac to form a thick paste which is worked into the hole and baked with torch. Other fillers are made of litharge mixed with glycerine, with water glass or with dental cement. A large hole may be filled with a block of mica set in with shellac. JAMES DIXON.

Cleveland, Ohio.

COMMUTATOR TROUBLES, CAUSES AND REMEDIES

	Trouble	Cause	Remedy
Brushes	Pitting, general	Contact resistance too low	Higher contact-resistance brush
	Pitting, certain brushes	Not lined with commutator bars	Line with bars
		Cover too many bars	Use thinner brush
	Glowing	Same as pitting	
	Sparking	Wrong position or spacing	Correct position
		Electrical unbalance	(See details above)
	Sparking, under load	High armature reactance	Install interpoles
	Sparking, at certain brushes	Corresponding interpole too weak	Insert shims on interpole
		Corresponding interpole too strong	Remove shims; attach shunt to interpole
		Brush arm off neutral	Shift arm
		Short circuit in interpole	Remove short
Commutator	Gray	Protruding mica	Put in gritty brush of same electrical properties; undercut mica
		Vibration; shaft throw	More lively holder
		Eccentric commutator	More lively holder; turn commutator true
		Dirty	Clean
	Black spots	Vibration; shaft throw	More lively holder
		Eccentric commutator	More lively holder; turn commutator
		Poor joints between commutator and coils	Resolder bad joint
	Ring fire	Protruding mica	Put in gritty brush of same electrical properties; undercut mica
		Carbonized mica which has absorbed oil	Dig out mica and fill (formula for filler above)
	High mica	Brush may be soft	Put in gritty brush of same electrical properties; undercut mica
	Flat spots	Overload has been on machine; loose bars	Tighten commutator while hot and turn true
	Hot commutator	Excessive brush pressure	Loosen brushes
		Insufficient lubrication	Insert one graphite brush per arm, staggered; apply parafine (temporary)
		Brushes off neutral	Shift brushes
		Brush density too high	Use larger brush
	Unsoldered tails	Bars short-circuited	Remove short circuit
Brush holders	Hot	Bad contact with brush	Clean; use pigtail brushes
Coils	Burned out	Bars short-circuited	Remove short

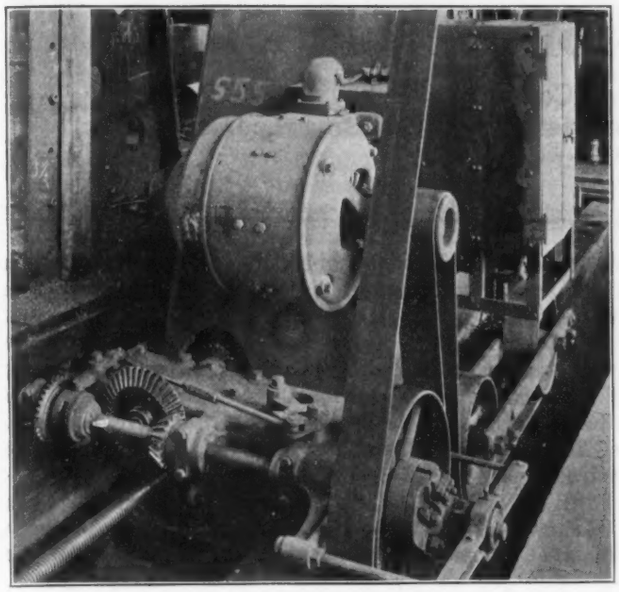


FIG. 1—MOTOR MOVES WITH TOOL CARRIAGE OF MILLING MACHINE
Automatic control switches are mounted in box to right of motor

Motors and Control Mounted on Large Milling Machine

A DIFFICULT problem in mounting a motor and control equipment on a Sellers milling machine used for milling large pieces was accomplished in the manner shown in the halftones in the shops of the Chapman Valve Manufacturing Company, Indian Orchard, Mass. The 10-hp. motor (Fig. 1) is mounted on the machine and travels with the tool-carriage frame, propelling it as well as driving the cutting equipment and feed mechanism. In this case the frame of the tool was large enough to provide an excellent base for the motor bolting, and there was space on the side of the frame to carry a light metal structure supporting a cabinet which contains a Cutler-Hammer automatic-control installation. This light structure is made up of 1½-in. x 1½-in. x $\frac{5}{16}$-in. (38-mm. x 38-mm. x 5-mm.) angles bolted to the tool frame by $\frac{3}{8}$-in. (1-cm.) bolts. By using a single pulley and a long belt one motor suffices for all the machine service, idler pulleys being freely used to make the necessary changes in direction.

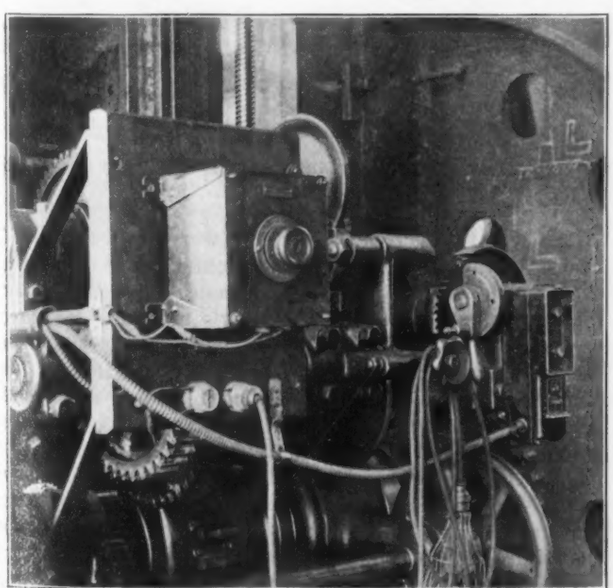


FIG. 2—RHEOSTAT AND PUSH-BUTTONS CONVENIENT TO OPERATOR

The mounting of the push-button control box and of a speed-controlling rheostat (Fig. 2) presented much difficulty on account of the absence of adequate plane surfaces on the machine frame within easy access of the operator. It was finally determined to mount the rheostat on a 16-in. x 18-in. x ¼-in. (40-cm. x 45-cm. x 3-cm.) wooden base supported by 1½-in. x $\frac{5}{8}$-in. (3.8-cm. x 1-cm.) iron straps attached to the bearing housing. The button box was attached to the bearing frame by a short, thin plate of steel. The leads connected with the rheostat and the leads to the push-buttons were of armored flexible conductor which was clipped to the edge of the baseboard.

W. B. ATCHINSON,
Electrical Engineer,
Chapman Valve Manufacturing Company.
Indian Orchard, Mass.

Changing a 220-Volt Direct-Current Motor for Operation on 110 Volts

A 220-VOLT, 10-hp., 1,200-r.p.m., four-pole, shunt-wound motor was recently received at a New York repair shop with a request to make the necessary changes to operate it on 110 volts at the same power. For operation on 110 volts instead of 220 volts without changing the horsepower or speed, the number of turns in series on both armature and fields had to be halved while the wire cross-section was doubled. As the field coils were in good condition, they were changed from a series to a parallel connection for operation at 110 volts. The armature, however, was badly roasted and therefore had to be rewound. The armature had 37 slots and 111 commutator bars. The coil pitch was 1 and 10 and the throw of the leads 1 to 57, making a single series, two-circuit, progressive winding of three coils per cell and six coils per slot. The coils were wound with two No. 16 double-cotton-covered wires in parallel, the first coil having three turns, the second coil four turns and the third coil three turns. In other words, one coil in every three had four turns while the rest had three turns, the coils being arranged in this order: 3-4-3-3-4-3.

It was possible to rewind the armature as it had been wound before and to connect the coils in a single-parallel, four-circuit winding for 110-volt operation; but to simplify the work of making the coils and connecting them on the armature it was decided to use a single-series two-circuit winding with only half the number of turns of No. 13 wire, which has twice the cross-section of the No. 16 used before. In the original winding there were 3 + 4 + 3 turns per half a slot, or ten turns. For the 110-volt winding, therefore, the turns should be five per half a slot, which were divided in the order of 2 — 1 — 2 turns in consecutive coils. Therefore thirty-seven coils were wound of two No. 13 double-cotton-covered wire in parallel, twenty-four of these coils having two turns and thirteen having one turn.

In order to facilitate assembling, red, white and blue sleeving was placed on the ends of coils while winding.

Bronx, N. Y. C. A. JOHNSON.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Benefits from Bonus Plan for Store Salesmen

AFTER experimenting with a straight 5 per cent commission as an inducement to employees to obtain information leading to sales of electric appliances and finding it only partially satisfactory, the Portland (Ore.) Railway, Light & Power Company has adopted the plan of giving a bonus to its electrical store salesmen.

The company has found that the interest of the store salesmen cannot be maintained consistently without stimulus. On the straight salary basis attention to customers tended to become perfunctory. The plan now adopted is to divide 5 per cent of the gross profits between the store salesmen, payable at the end of the fiscal year in accordance with the amount of sales made by each. Under this system one man has earned as much as $484 and no salesman in the store has received less than about $200. If an employee leaves during the year, his bonus for that period is divided among the others.

This plant stimulated sales to such an extent that $2,000 has been available for distribution among the store salesmen at one time. Furthermore, it has been observed since the adoption of the plan that customers receive more prompt and satisfactory attention and that the salesmen are encouraged to follow up "prospects." This is believed to be due not merely to an increase of effort but also to the fact that effort is far more intelligently directed when a personal gain depends upon the success of each sale.

Features of Agreement to Build Rural Lines

FOR the sum of $600 per mile (1.6 km.)—50 per cent upon execution of the contract and 50 per cent when the line is completed and energized—the Peterson (Iowa) Power & Milling Company will build single-phase, 6,600-volt rural lines for farmers. Twenty-eight 6-in. x 30-ft. (15-cm. x 9-m.) good cedar brush-treated poles per mile will be erected, with standard Washington fir cross-arms, No. 6 medium-hard-drawn copper wire, and galvanized hardware. Each mile of line will be built independently. Standard copper wire will be used over all highways and railroad crossings.

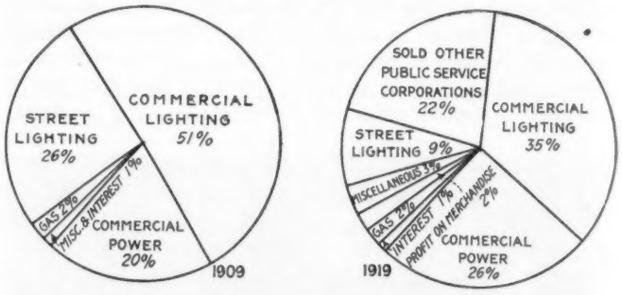
The customers agree to trim all trees when necessary to allow for the construction and operation of the line and to make all negotiations and settlements with the telephone companies affected by the building of the line. The line becomes the property of the customer when it has been built and paid for according to this agreement.

The agreement becomes operative when the signatures of an average of two customers per mile have been obtained. In case additional customers want connections not provided for in the contract, the company may sell the additional connection privileges for not less than the amount paid by the original subscribers. The money received by the company for this purpose must then be distributed equally among the original parties to the contract. All customers agree to pay individually for the transformer and for all equipment leading from the copartnership transmission line to their premises.

Each customer signs a separate service contract agreeing to purchase service for twenty years at a minimum charge of $50 per year for service from a 3-kva. transformer, and $60 per year if a 5-kva. transformer is installed. The customer is allowed 425 kw.-hr. for the $50 and 500 kw.-hr. for the minimum charge of $60. Any excess consumption has to be paid for at the rate of 8 cents per kilowatt-hour. The minimum charge is paid quarterly in advance.

Sources of Central-Station Income

THE accompanying charts, which have been prepared by the Narragansett Electric Lighting Company, Providence, R. I., show in an interesting way what proportion of total income each class of customers contributes. One chart shows how the company's income was divided in 1909 and what changes had taken place during the ten years to 1919. When the company began operation its total income was received from commercial lighting. In 1884 a contract for street lighting was obtained and the sources of income were thus increased. Power installations were added from time to time, but even as late as 1909 street and commercial lighting furnished 77 per cent of the company's revenue. A study of the chart shows that in 1909 street lighting furnished 26 per cent of the total, while in 1919, although the amount received for this service had not decreased, receipts from other sources had increased to such an extent that the income from this class of business amounted to only 9 per cent of the company's total revenue. In 1909 practically all energy generated was transmitted and sold directly to the consumer. Since that time, however, the company has been selling energy to other public service corporations, so that now 22 per cent of its total revenue is from that source.



DIVISIONS OF INCOME OF NARRAGANSETT ELECTRIC LIGHTING COMPANY FOR 1909 AND 1919

Central Stations Need Quality Customers

THAT the promised saturation of rural lines has not materialized and that there is an increasing demand for extensions was the assertion of P. H. Palmer of Kokomo, Ind., in an opening address before the Fort Wayne meeting of the Commercial Section of the Indiana Electric Light Association. "Central stations," Mr. Palmer went on, "cannot arbitrarily refuse to extend their lines as they did during the war, even though wartime financial conditions still prevail. Central-station commercial men have become accustomed to having their activities limited, and they have learned to analyze the characteristics of customers' load and pick out those which are most desirable for the central station. The loading up of existing lines is one of the principal functions of the sales department today. However, the salesman must consider power factor, load factor and the time of maximum demand, none of which were given much thought in pre-war times."

Combating Water Shortage and Cost of Oil in Southern California

CHARLES H. PEIRSON, in the March issue of *Edison Current Topics*, the house organ of the Southern California Edison Company, Los Angeles, makes the following statement concerning the threatened power supply and the ways proposed for meeting it:

"Southern California is confronted with a shortage of precipitation that is unparalleled in the past twenty-five years. It follows directly upon three years of embargo upon hydro-electric developments as a result of war conditions and has resulted in a stringency of power supply which can be met only by a scientific shifting of the agricultural load. Officials of the company are endeavoring so to distribute the hydro-electric energy during the peak months of agricultural demand—July, August and September—that crops will not suffer from want of irrigation, manufacturing will not be interfered with, nor light or domestic service curtailed. The demands of the war have increased production enormously, in some instances as high as 40 per cent, which is very largely reflected in irrigation requirements.

"General Agent S. M. Kennedy has had several meetings with the district agents and has impressed upon them their responsibility in protecting the production of the foodstuffs of the land and keeping the wheels of industry in motion during the coming summer. That the conservation of electric power is the big question of the moment in southern California there can be no doubt, and Mr. Kennedy and his associates have worked out a tentative plan by which it is hoped that a great saving in electrical energy can be effected through night irrigation, which has the advantage of lessening water losses through evaporation, and through alternating the operation of plants working fifteen days or less every month and limiting the operation of plants working more than fifteen days a month to off-peak hours, from 10 p.m. till 8 a.m., on week days. No embargo will be placed on Sunday irrigation. The whole idea is a new one, but it is in line with the conservation of energy and the lowering of high costs, and it is believed that the agriculturists and manufacturers will co-operate.

"The shortage of water for hydro-electric plants is going to cost the Southern California Edison Company approximately $2,000,000 above the normal cost of generating by steam 200,000,000 kw.-hr. of electrical energy necessary to meet the extraordinary condition for an emergency shortage. The company has made application to the Railroad Commission for an emergency rate increase based upon facts that are briefly as follows:

"There have been three years of subnormal precipitation coincident with the years of war embargo on material which was necessary for constructing power plants; there were strikes in the steel industry in the East and in San Francisco, delaying the delivery of material required for work that is under way, and the Southern California Edison Company during the coming summer season must face the proposition of increasing generation by the use of steam plants that it owns or can secure, notwithstanding greatly advanced prices for oil, which will have to be bought in the open market. During previous water shortages the company has been able to generate its auxiliary steam load by using its modern and efficient steam turbines, which generate electricity at the smallest expenditure for oil. This year it will have to use additional plants of types which are older and less efficient and which will use more oil in proportion to the amount of energy generated.

"Without some measure of relief from the Railroad Commission, the company would probably have to reduce the supply of energy for irrigating purposes by one-half, and thus restrict the production from more than 200,000 acres of cultivated land. The productiveness of each acre is estimated by experts to average $100. Thus it would appear that a power shortage would mean a loss to the agricultural community under the Edison lines of $20,000,000 during the ensuing year."

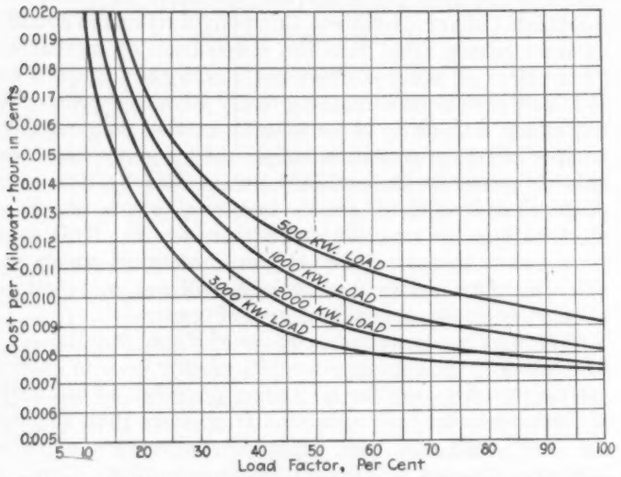
The Electric Furnace and Central-Station Rates

THE need of closer co-operation between the electric furnace user and the central station was emphasized in several papers presented at the Boston joint meeting of the American Electrochemical Society and the American Institute of Electrical Engineers. H. L. Hess, Hess Steel Corporation, Baltimore, Md., pointed out that basic differences of opinion in the steel mill and central station cause differences of ideas concerning billing for power. He maintained that it is unusual, if not impossible in most cases, for the steel-melting plant to use the allowances of the power company and obtain the minimum kilowatt-hour charge, although it was admitted that the method of billing by a service or demand charge and an energy charge is entirely fair. In dull times it is especially difficult to produce steel cheaply, in comparison with flush times, on account of the demand charges being maintained through both dull and busy periods. In one case this situation has been relieved by the establishment of a new demand for each interval of six months. This permits increase of equipment on both sides and does not impose a long term of undue hardship on either party, be times good or bad.

W. G. Berlin, electric furnace operator for the Taylor-Wharton Iron & Steel Company, High Bridge, N. J., pointed out that the smaller power companies cannot, and the less progressive will not, equip themselves to handle the new furnace loads without charging excessive rates; for they must take account of the impossibility of selling their capacity to some other industry in case the furnace is abandoned. Furnace loads with fluctuating characteristics should necessarily be connected to a central station turning out large

blocks of energy, otherwise the heavy surges caused by poor contact and intermittent arcs would produce poor voltage regulation on the central-station system.

From the consumer's standpoint rate schedules appear unduly complex. It is unnecessary for the furnace operator to be confused, however, for if he will state his operating conditions, the power engineer will figure the rate and explain it very quickly. The most essential factor to the furnace operator is the cost



CURVES SHOWING HOW POWER RATES VARY UNDER DIFFERENT LOAD FACTORS AND SIZES OF INSTALLATION

of power per ton of steel produced. The following wholesale power rate may be taken as a fair example of the average make-up of rates submitted to a large power user:

RATE PER MONTH:

(1) Demand charge:
For the first 200 kw., $1.50 per kw.
For the next 800 kw., $1.00 per kw.
For excess over 1,000 kw., 75 cents per kw.

Plus:

(2) Energy charge:
1.5 cents per kw.-hr. for the first 10,000 kw.-hr. used per month.
1.0 cent per kw.-hr. for the next 90,000.
0.8 cent per kw.-hr. for the next 200,000.
0.6 cent per kw.-hr. for excess over 300,000.

Maximum demand determined, at option of company, from the customer's connected load (total of name-plate ratings) or by suitable instruments—same to be calculated by averaging the daily recorded maximum thirty-minute peaks of the month. The succeeding eleven months' billing to be based on these calculations, unless the connected load is increased.

Minimum charge for any month, whether energy is used or not, to be no less than the demand charge.

Deduction of 5 per cent on the demand charge when the customer takes and measures current at power company's primary voltage.

Successive deduction of 5 per cent on the total bill for payment within ten days from date of bill.

No discounts for use of off-peak power considered.

No deductions for maintenance of good power factor considered.

The accompanying curves show the average rates that would apply under various conditions of furnace operation on the above rate schedule. For example, a 3-ton furnace operating on a demand of 1,000 kw. and a load factor of 20 per cent (which would be the operating conditions running single shift and turning out three heats a day) would earn a rate of 1.6 cents per kilowatt-hour. The same furnace operating on a twenty-four-hour schedule, or a load factor of say 45 per cent, would earn a rate of 1.1 cents per kilowatt-hour. Where the power consumption per ton of steel would be 700 kilowatt-hour the saving in power alone would amount to $3.85 per ton of metal. Under the same conditions, a furnace with a demand of 3,000 kw. and operating on a load factor of 20 per cent would earn a rate of 1.35 cents per kilowatt-hour, and if operating with a 45 per cent load factor, the rate would be 0.9 cent per kilowatt-hour. This shows that the larger furnace using the larger block of energy, even with the higher demand, will earn a rate which if considered alone would favor the larger furnace installation; also that the smaller furnace operating a larger number of hours will earn a rate far better than a larger furnace operated only a few hours. For example, a 3-ton furnace operating at 1,000 kw. demand and having a 45 per cent load factor would earn a rate of 1.1 cents per kilowatt-hour, while a larger furnace with a demand of 2,000 kw. and on a 20 per cent load factor would only earn a rate of 1.47 cents per kilowatt-hour. The advantage, of course, is with the smaller furnace operating at full capacity rather than with the large furnace at half capacity.

Parallel operation of two or more electric furnaces taking power from a single power station is economical where there is an ample and reliable power supply, provided that they are run to capacity, and bearing in mind that the rate per kilowatt-hour depends on the load factor more than on the demand.

Porch Lighting to Prevent Robberies in City of Denver

IN DENVER, Col., the civic and legislative bureau of the Civic and Commercial Association has proposed a plan, it is stated in the April number of *Doherty News*, to have every resident of the city keep a light on his porch burning at night. This plan, according to the committee, would considerably brighten the aspect of the residential section and in a large measure do away with hold-ups and other crimes on dark streets.

The Denver Gas & Electric Light Company has agreed to supply the power for one 20-cp. light to be used on the porch from dusk to midnight for 30 cents per month, and if residents wish to burn the light all night, the cost will be 50 cents per month.

Avoiding Overcharge Complaints by Educating the Public

ON THE theory that overcharge complaints are more easily avoided than satisfied, the Santa Cruz (Cal.) office of the Coast Counties Gas & Electric Company has for some time been conducting special classes in meter reading. The work is under the direction of M. L. Smith of that office and consists of a brief explanation of the meter dial and the method of figuring bills, as well as other simple electrical information of value to the housewife. Much interest has been shown in these classes, which are held Saturday afternoons between 2 and 5 o'clock, the attendance for the first few weeks averaging seventy-five. The value to the company is indicated by the fact that overcharge complaints have virtually ceased. Ninety per cent of this result is credited to the better understanding which the customers have gained from the weekly lessons.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

A Unique Design of Waterwheel-Driven Alternator.—A. E. GLASS.—The waterwheel-driven alternator described in this article is one of three which are being built to operate in a power house hewed out of the solid rock of a mountain in Norway. The conditions which prevail in this most unusual installation have necessitated the adoption of a unique design for the generating units. These features of design are clearly explained and illustrated by the author.—*General Electric Review,* February, 1920.

Finding the Polarity of Transformer Coils.—PAUL GIRAULT.—The polarity of transformer coils may conveniently be determined by means of direct-current ballistic methods. For this purpose a certain coil on the transformer is excited by direct current, and the deflection on a direct-current voltmeter connected across any other coil or combination of coils is observed when closing the circuit. The author has in an earlier communication given certain theorems by the aid of which this method may be extended to polyphase transformers (*Rev. Gén. d'El.,* Jan. 20 and Dec. 29, 1917). In the present article the whole method receives a thorough mathematical analysis and also the theorems are generalized.—*Revue Générale d'Electricité,* Feb. 21, 1920.

Generation, Transmission and Distribution

Communication Between Power Stations.—A. LAUCAGNE.—A side issue in power distribution which deserves the most careful consideration is the problem of obtaining and maintaining a reliable intercommunication service, by telephone or telegraph, between the different power stations in an interconnected system and between the generating station and its various substations. The obvious course is to install telephones connecting to the commercial telephone systems. This, however, has the grave disadvantage of sometimes causing serious delay in case of trouble on the power lines, when immediate connections are imperative. It remains for the power company to install its own telephone system, with its lines for convenience and reasons of economy carried on the transmission-line poles. By careful transposition and by use of drainage coils, etc., the interference can be brought to a minimum, but in case of break on a power conductor the telephone usually gets out of order at the very moment when it is most urgently needed. In such a case temporary telephone service may be maintained over one of the remaining power conductors of the disconnected power line. However, a more satisfactory solution seems to be the use of radio-telephone sets similar to those developed during the war for field service. These and other points are brought out by the author, who concludes that in every system there ought to be a private intercommunicating telephone system for the load dispatcher's use and in addition thereto a system of radio-telephone stations for use in emergencies and also for communicating with repair gangs working on the lines.—*Revue Générale d'Electricité,* Jan. 31, 1920.

Improvements in Electric Coal-Handling Machinery. SYKORA.—The article describes some interesting details of design of modern Austrian coal-handling machinery such as is used in coaling steam locomotives. Three systems with different drives are discussed—three-phase induction motors, alternating-current single-phase motors of the Déri repulsion type with speed adjustment by means of movable brushes, and finally direct-current drive. Special attention is given the Brown-Boveri motor brake. This brake is operated by a heavy cast-iron weight, suspended by inclosed springs with strong oil damping, an arrangement which eliminates absolutely all shocks and jars in setting the brake. The brake weight is lifted by a small auxiliary electric motor, which is run only while lifting the brake and thus consumes very little power.—*Elektrotechnik und Maschinenbau,* Feb. 29, 1920.

Installations, Systems and Appliances

Electric Starting Systems for Automobiles.—F. C. BARTON.—The design, characteristics and operation of the single-unit, two-unit and combination-unit types of starting and lighting of automobile equipment are discussed in great detail. Description and examples are also given of the methods employed in selecting the size of units for assumed requirements. The author relates what has been done by the Society of Automotive Engineers in standardizing the mountings of starting motors and lighting generators.—*General Electric Review,* March, 1920.

Contactors for Tapping Transmission Lines.—ACH. DELAMARRE.—With electric motors in ever-increasing sizes being used in agricultural field work, it becomes increasingly difficult to supply these motors at such a low voltage that an accidental touching of the conductors will not be dangerous. Portable transformer stations therefore are used where the secondary side is in one way or another tapped off a medium-voltage transmission line. In a system due to the Siemens & Halske Company the line is at certain intervals provided with tapping points in the form of hooks. The heavily insulated intake cables of the transformer end in rings which may be hung on the hooks. In another system the contactor itself is made in the form of a hook, carried on a long bamboo stick, and may be put across the line conductor at any place. The author criticises these systems and draws attention to their danger when handled by electrically unskilled men. A new type of contactor is suggested which consists of a special plug contact built into a porcelain insulator of suitable voltage rating. One such plug terminates each intake cable, and corresponding receptacles are provided on certain poles at convenient points along the line. *Revue Générale d'Electricité,* March 13, 1920.

Electrophysics and Magnetism

Corona Discharge.—EARLE H. WARNER and JAKOB KUNZ.—This bulletin represents a study of direct-current corona extending over a period of several years under the direction of Dr. Jakob Kunz at the University of Illinois. The corona discharge was studied and measured at both positive and negative wires in air at different pressures and in hydrogen at different pressures. The effects of moisture and temperature were also investigated. As a result of this work Dr. Kunz suggests the following equations for corona dicharges:

$$Ki = \frac{Vo}{e}(P_i - P_o)\frac{1}{t} + \text{a constant},$$

where i is the corona current, V_o the volume of the tube, e, the potential difference between the wire and the tube, $P_i - P_o$ the pressure increase, K, a constant and Po the initial pressure.—*Bulletin No. 114, Engineering Experiment Station, University of Illinois.*

Ionization and Resonance Potentials for Electrons in Vapors of Lead and Calcium.—F. L. MOHLER, PAUL D. FOOTE and H. F. STIMSON.—The resonance and ionization potentials of lead are 1.26 volts and 7.93 volts respectively. The line $\lambda = 10{,}291$ gives the probable theoretical value of the former as 1.198 volts. Calcium has two resonance potentials, 1.90 volts and 2.85 volts, of which the first is more prominent. Ionization was observed at 6.01 volts.—*Scientific Paper No. 368, U. S. Bureau of Standards,* Feb. 26, 1920.

Units, Measurements and Instruments

A Method for Measuring Frequency.—AUGUST ZACEK.—The test circuit is divided into two branches, one containing a purely ohmic resistance, the other containing an inductance coil. In each branch furthermore is inserted the heater of a thermo-element. The thermocouple ends of these thermo-elements are connected to the two windings of a direct-current differential galvanometer. The resistance branch is varied till the galvanometer shows zero deflection. The frequency may then be easily calculated from the circuit data.—*Physikalische Zeitschrift,* Aug. 1, 1919.

Measurements at High Frequencies.—In connection with military developments in radio engineering some very valuable research in high-frequency precision measurements was carried out in France during the war, mainly through the energies of M. Armagnat. Some of the results of this work have now been compiled by Léon Brillouin. Much attention was given the question of accuracy in radio direction finding. The great importance of exact tuning of the circuits in the Bellini-Tosi radiogoniometer was emphasized by the experimental results, and it was found that very large errors may result from parasitic currents in the apparatus. For the purpose of determining the effective resistance of coil antennas an interesting method was devised, according to which the heating of the coil due to a known high-frequency current was observed by measuring the direct-current resistance of the winding. Another feature is a very accurate nul-method for comparing wave meters. An interrupted current from an aperiodic buzzer circuit was passed through two coupling coils, each coupled to one of the two wave meters to be compared. By means of two other coupling coils and an aperiodic detector-telephone circuit so arranged that there is no direct induction from the buzzer circuit, the wave meter may be adjusted for zero sound in the telephone, which corresponds to an equality in tuning of better than one part in one thousand.—*Bulletin de la Société Française des Electriciens,* August-November, 1919. (Abstracted in *Revue Générale d'Electricité,* Jan. 31, 1920.)

Miscellaneous

Electric Dredging of the Yukon.—ALLEN E. RANSOM.—The writer states that the analysis of a dredging proposition should be made under the following headings: (1) Quantity of gold-bearing gravels in the properties acquired; (2) distribution and value of gold contents; (3) depth and character of gold to be worked; (4) cost of labor, transportation and supplies; (5) length of operating season each year; (6) cost of power operation and maintenance; (7) quantity, nature and cost of removal of overburden soil; (8) proportions of gravel to be treated by hydraulicking hill claims, ground-sluicing bench claims and dredging river-bottom claims; (9) cost of thawing glacial frozen gravel; (10) cost of thawing plant, operation, fuel and maintenance; (11) clear titles; (12) continuous claim-dredging permits to prevent holding back of dredging operations; (13) keystone placer drill-hole tests on all claims ahead of the dredges, hydraulic or sluicing flumes. For two typical dredging operations, one with a capacity of 5,000 cu.yd. (3,820 cu.m.) a day and the other with a capacity of 12,000 cu.yd. to 16,000 cu.yd. (9,180 cu.m. to 12,200 cu.m.), data are given in the table, not including the cost of thawing ground.—*Electric Journal,* March, 1920.

	Yukon No. 5	Canadian No. 3
Running time	3,189 hours	5,745 hours
Power consumed	461,590 kw.-hr.	2,457,200 kw.-hr.
Ground worked	801,667 cu.yd.	2,341,910 cu.yd.
Total operating expense	$34,227	$86,376
Cost per cubic yard	4.28 cents	3.67 cents

Power-Factor Correction.—M. NOTT.—A summary of power-factor-correction schemes is given in the following table:

Apparatus	Advantages	Disadvantages
Phase advancers	Small kw. absorbed. Can be used with normal induction motors	Not standard machinery; alternating-current commutators.
Static condensers	Extremely high efficiency. Low maintenance charges. Has no moving parts	Bulky and inflexible of adjustment, also danger of surges.
Rotary converters	High efficiency where direct-current load is required	Not suitable for running at more than unity power factor; voltage variation causes variation in power factor.
Motor-generator sets	More adjustable than rotary converters	Low efficiency; large amount of floor space.
Synchronous condensers	Very good control of wattless current	Mechanically "idle" machines.
Synchronous motors	Also good control and constant speed	Heavy starting current on expensive starting apparatus.
Synchronous induction motors	Good control; self-synchronizing and comparatively small starting current	Subject to limitations in design due to rotor voltage.

The author states that it is commercially economical to work at a power factor in the neighborhood of 0.9 and where low load factors and slow-speed induction motors are used it is advantageous to use some method of correcting the power factor to approximately this value.—*Beama,* March, 1920.

Scientific and Industrial Research

(PRINTED IN THE THIRD ISSUE OF EACH MONTH)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF
Cornell University, Ithaca, N. Y

Research in Progress or Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

HEAT-INSULATING PROPERTIES OF MATERIALS USED IN FIRE-RESISTIVE CONSTRUCTION.

A comparison of the relative efficiencies of the different classes of materials commonly used in fire-resistive construction to protect load-bearing members from the heat of an accidental fire has recently been made in an investigation by the Bureau of Standards. All materials were made up into specimens in the form of solid cylinders, 8 in. (20 cm.) in diameter and 16 in. (40 cm.) long. These were tested separately in a specially designed gas-fired furnace, the furnace temperature being raised gradually to 927 deg. C. in ninety minutes and held at approximately that point for two hours. The investigation included three clays that are used for the manufacture of terra-cotta tile, concrete from two mixtures, 1:2:4 and 1:3:6, with a number of different coarse aggregates, gypsums of several different mixtures from raw materials from different parts of the country, and lime mortar. The most rapid heat penetrations were found in the denser specimens of the burned clays. A porous burning clay, light-burned, heated through as slowly as most of the concretes and much less rapidly than the denser, harder-burned clays. No clay specimens of the porosity of terra-cotta lumber produced by the addition of sawdust were included. The results are consistent with earlier information as to the relative thermal qualities of the three classes of materials, burned clays, concretes and gypsums, but are favorable to members of each class; namely, porous clays, limestone concretes and the denser gypsums. The showing of gravel concrete both thermally and in respect to loss of strength was unfavorable. —*Walter A. Hull, Bureau of Standards, Washington, D. C.*
[This is important in building bus compartments.—EDITOR.]

MAGNETIC TESTS OF STEEL RODS IN INTENSE FIELDS.

A method has been developed whereby megnetic tests can be made upon long rods in intense fields. The apparatus consists essentially of a Du Bois electromagnet with flat pole pieces separated by an air gap and pierced coaxially so that a rod may be extended through them and the electromagnet. Surrounding the specimen are three coaxial test coils wound on brass forms. When the inner coil is connected in series with a balistic galvanometer the normal induction is measured by the throw of the galvanometer upon reversal of the magnetizing current. By connecting either the inner and middle or middle and outer coils in opposition the value of the magnetizing force is determined. Normal induction curves obtained for a number of specimens of different materials show very good agreement with similar curves obtained by the Burrows method within the range of the latter. Hysteresis values, however, have not proved so reliable. In some specimens there seem to be two constituents of different degrees of hardness which reach the maximum intensity of the magnetization for different values of H.—*W. L. Cheney, Bureau of Standards, Washington, D. C.*

TRANSMITTER, CONDENSER TYPE.

In a recent paper in the *Physical Review* (Vol. 10, p. 39, 1917), E. C. Wente has given an account of the condenser transmitter which he developed for the purpose of measuring sound intensities in absolute terms. This instrument has a sensibility which is nearly uniform over a large range of frequencies—a property which results from the high stiffness and dissipation brought into play by the air film between plate and diaphragm. A study of air damping and elasticity as they occur in this instrument shows that both damping and stiffness can be calculated according to a simple theory and that there are important frequency variations in these quantities. For example, Wente found that the damping coefficient of his system at resonance was of the order of 6,000, while theory and experiment show that the damping at 100 p.p.s. is more than 100 times as great. The theory enables an absolute calibration curve to be readily computed which is sufficiently accurate for practical purposes. The mechanism of air damping has been determined, and formulæ have been obtained from which practical calculations can be made. The principle has also been given for the design of a simple air-damped system which has rigorously uniform sensitiveness over an extended range of frequencies including zero.—*I. B. Crandall, Research Laboratory of the American Telephone & Telegraph Company and Western Electric Company, Inc., New York City.*

Suggestions for Research

FIELDS, ELECTRIC AND MAGNETIC, MEANS FOR PLOTTING.

The methods suggested in the past by different investigators are not entirely satisfactory. The problem is becoming of greater practical importance every day, and a satisfactory method of mapping out and plotting irregular fields of force would be of great scientific and commercial value.—*C. Fortescue, Pittsburgh, Pa.*

INSULATION, SERVICE TEST ON.

The question of periodically testing the insulation of generators, motors, transformers, etc., in actual operation is of extreme importance for obtaining uninterrupted service. The resistance test of insulation is of very little value, because it does not indicate the actual physical condition of the material. The high-potential test may break down a weak spot which otherwise would have stood in regular service for a considerable length of time. It is desirable to develop a new test which would combine the advantages of the two and give a reliable indication of deterioration in a dielectric without further weakening it. A first step in this research may consist in collecting a large number of samples of insulation taken from machines of different age and condition of service. Such samples should be subjected to careful physical, mechanical and chemical tests for the purpose of determining that property which changes to the greatest extent with deterioration and therefore could be taken as a reliable criterion thereof.—*Editorial Suggestion.*

METERS, WATT-HOUR, IMPROVEMENTS IN.

Radical improvements are needed in the direct-current commutator meter. For important alternating-current metering installations a much more accurate meter should be made, even at the expense of much greater weight and cost. To accomplish this the braking flux due to permanent magnets should be very largely increased, and a very much higher grade of steel should be developed for use in the voltage magnet. —*H. B. Brooks, Bureau of Standards, Washington, D. C.*

POLYPHASE SYSTEMS, BOOSTER FOR CORRECTING UNBALANCE.

There are in this country a few large power distribution lines of the two-phase, three-wire type. With heavy loads the impedance drop in the common return conductor badly unbalances the phase voltages. Voltage regulators on each outside conductor will keep the phase emfs. approximately correct in magnitude, but the phase angle becomes considerably greater than 90 deg. It is desired to devise a stationary booster or a combination of boosters which would automatically compensate for the impedance drop in the common wire with varying load and would maintain the two-phase voltages at the proper magnitude and in phase quadrature.—*Editorial Suggestion.*

PORCELAIN, MATHEMATICAL EXPRESSION OF PROPERTIES.

Porcelain, concrete, ferro and other alloys are essentially conglomerates of two or more substances. The ultimated strength, modulus of elasticity and temperature coefficient of expansion of each of the constituents are different from the corresponding properties of any other component. Mathematical expressions of the properties of such materials in terms of those of their constituents are at present not available, and any theoretical research is desirable that would advance the value of our knowledge beyond the extent of experience.—*W. A. Hillibrand, San Francisco, Cal.*

POWER COLLECTION FROM HEATING PLANTS.

Dr. C. P. Steinmetz suggests that wherever fuel is burned in considerable quantities to produce steam for heating purposes the steam be generated at high pressure and first passed through a turbine connected to an induction generator tied into an electric supply system. The value of the recovered power would be a substantial percentage of the fuel cost, and, according to his computations, the saving in coal that such an arrangement would effect makes it a problem of considerable national importance (*Proceedings A. I. E. E.*, 1918, p. 614). It is urged that this arrangement be tried in a large city or in an industrial district in which a considerable amount of low-pressure steam is used. An opportunity arises every time an old boiler plant is being replaced by a new one.—*Editorial Suggestion.*

STEAM AUXILIARIES.

A study of steam requirements per ton of material handed from steam-jet ash conveyors would be of great interest; also a study of automatic feed-water regulators.—*J. M. Drabelle, Iowa Railway & Light Company, Cedar Rapids, Iowa.*

TRANSFORMERS, CURRENT, ERRORS IN.

Current transformers as now made are the most unsatisfactory link in the chain of devices used for metering alternating-current energy, and much better ones should be made available, so that meters could be adjusted to be accurate on the secondary energy.—*H. B. Brooks, Bureau of Standards, Washington, D. C.*

WELDING, ELECTRIC.

The research work on electric welding has only just begun and practice has preceded the scientific investigation. The field, therefore, is full of most interesting fundamental problems. The investigational questions may be grouped into three main divisions: (1) *Metallurgical.*—The metallurgist has yet to tell what the conditions of the metals are after the electrode material has fused with the parent metal and to determine the proper conditions for a good weld. This problem has in it a great many variables. (2) *Physical.*—The physicist must explain the atomic or electronic conditions which permit of the combinations at the high temperatures involved. (3) *Electrical.*—The electrical investigator must determine all the various phenomena connected with the preferences between and the advantages of the use of different forms of electrical energy and the varying characteristics of the electric circuit in producing different types of welds.—*H. A. Hornor, Proceedings, 1918, A. I. E. E., p. 1194.*

JOBBERS' sales have fallen off because an increased demand has absorbed most of the stocks which were available up to the time of the railroad embargo and which have been diminishing gradually since that time.

ONLY a small amount of electrical goods has been received by freight during the week, and sales must necessarily continue to drop off until shipments are greatly improved.

CONSIDERABLE shipping is being done by truck and by parcel post, but most of this activity is confined to short-haul shipments.

FAILURE by contractors and dealers to receive goods billed by jobbers has resulted in a slowing up of collections.

AN INCREASE in the price of heating appliances is expected to be made on May 15 by at least one manufacturer.

BUILDING contracts in 1920 to date are more than double those of the corresponding period last year. Demand for electrical goods has increased in even greater proportions.

EXPORTS of electrical materials during March exceeded those of February by more than $2,000,000. Port strikes are holding back shipments, and the export demand is not being filled because certain manufacturers have no policy of allotting a certain percentage of their output to that field.

FREIGHT tie-ups are holding back coal and raw materials from factories and power stations all over the country to such an extent that many mines and mills are closed down and electric power consumption is being curtailed in some districts.

DEMAND for high-tension farm switching substations is heavy in the Middle West and West and in Canada and is increasing at a favorable rate.

IN THE suit of the Consolidated Gas Company of New York City to have the legal rate declared confiscatory the special master declared that the company is not forced by its ownership of the electric distribution companies in that city to set profits from electricity against losses from gas.

A BUDGET of $27,000 will be raised by the electrical industry in California to finance the enlarged work of the California Electrical Co-operative Campaign for 1920.

A REFERENDUM is being taken by the United States Chamber of Commerce to ascertain the opinion of the business men of the country on the proposed federal Department of Public Works.

WILLIAM MARCONI is now conducting experiments from his yacht on the high seas in an effort to discover the cause of unexplained interference with radio operation.

AT THE annual business meeting of the American Institute of Electrical Engineers next Friday the Edison medal will be presented to W. L. R. Emmet.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

FIGURES of the Geological Survey on energy production for January and February are 124,300,000 kw.-hr. and 121,800,000 kw.-hr. respectively, of which one-third was produced by water power.

ORGANIZED opposition to the water-power bill as reported by the Congressional conference committee has developed, largely from New England, and there is danger of a filibuster that will prevent its passage before Congress adjourns for the national political conventions.

DEPLORING the restrictions which make it impossible for public utilities to raise capital in competition with unregulated enterprises, W. S. Barstow told the ELECTRICAL WORLD that these companies must look to their consumers and employees to buy their securities.

IN A FOUR weeks' campaign the Metropolitan Edison Company of Reading, Pa., sold through its employees to employees and customers $558,600 of 7 per cent preferred stock.

CENTRAL stations in the Middle West, including the Commonwealth Edison Company of Chicago, have stopped soliciting all business except on off-peak basis. This is due to lack of reserve capacity and inability to get funds with which to build new plants.

ARTHUR WILLIAMS, speaking before the New York Electrical League, emphasized the duty of the electrical industry to take part in public work.

ALTHOUGH Chicago utilities should spend $80,000,000 before the end of 1921 to extend their operations, they are unable to raise that sum in the present credit situation, according to Samuel Insull's statement at a hearing before the Illinois Public Utilities Commission.

OBJECTION to the provision of the sundry civil appropriation bill carrying $125,000 for a survey of power production and distribution on the Atlantic Coast was made by several members of the House of Representatives, but the item was carried by a large majority.

SIX SUBSIDIARIES of the Lehigh Power Securities Corporation of Philadelphia, together with the Pennsylvania Lighting Company, are likely to be merged into a new corporation to be called the Pennsylvania Power & Light Company.

DENIAL of reports that it has purchased stock of the German General Electric Company is made by the General Electric Company of this country.

A BLOCK of $5,000,000 of twenty-five-year 6 per cent general and refunding mortgage gold bonds is being offered by the Southern California Edison Company at 88½, which will yield 7 per cent.

ABOUT 125 members and guests attended the Power Club meeting at Chattanooga, Tenn., last week. Plans for broadening the club's activities were discussed and a change of name was proposed.

ADDRESSING the convention of the Southwestern Electrical and Gas Association at Galveston, Tex., George L. Burr of the Guaranty Trust Company, New York, declared that the solution of the utility credit problem lies in local investment.

FIVE proposed amendments to the constitution of the Illuminating Engineering Society have been placed before the members for letter ballot.

MARKETING methods employed in different sections of the country were outlined by delegates to the convention of the Electrical Supply Jobbers' Association at Del Monte, Cal., this week.

A RESOLUTION favoring more uniform rates for Hydro-Electric customers in the various parts of the province has passed the Ontario Legislature.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Harry A. Wheeler Suggests Additional Rate to Absorb Higher Costs

PREVIOUS witnesses were cross-examined, other witnesses testified and additional solutions were suggested for the credit and financial problems of public utilities at the continuation of the general hearing before the Public Utilities Commission of Illinois in Chicago this week. The hearing was adjourned until May 26.

Harry A. Wheeler, vice-president of the Chicago Union Trust Company and for three years president of the Chamber of Commerce of the United States, advocated a fair normal rate of return for utilities plus an increased rate which would be sufficient to permit the companies to pay off the present excess cost of men, money and materials out of a few years' earnings. Only the normal cost of present financing and construction should be passed on to future generations, Mr. Wheeler held.

The Interstate Commerce Commission started the public distrust in utilities securities, according to Charles Piez, who was general manager of the Emergency Fleet Corporation. He also said it was essential to the prosperity of a business community that public utility development should lead and not lag behind industrial development.

Possibility of Senate Filibuster on Water-Power Bill

NO OPPORTUNITY was offered on Tuesday to call up in the Senate the conference report on the water-power bill, although it had been the plan to open discussion on the conference bill on that day. Owing to the fact that organized opposition to the measure had developed and extended debate was in prospect, the leaders insisted on taking up the Knox peace resolution. The conference report on the water-power bill will not be taken up until after the peace resolution is out of the way.

The opposition to the conference bill comes largely from New England, although Senator King of Utah has announced that he will fight the adoption of the report. There is a chance that most of the opposition may be mollified by minor changes in the language of the conference bill. The opposition has all plans laid for a filibuster against the bill. In view of a pending adjournment until July 12 the chances are good for a successful filibuster. The stand taken by the opponents of the conference committee bill is virtually that of Senator Fernald of Maine, who expresses his opinion of the bill in the following language:

"I am against the licensing system. The states shou'd have the right to determine their own policy for regulating the use of water power. Maine has determined that electricity generated by water power shall not be carried out of the state. This bill overthrows the state's policy of regulating the use of water power. Under this bill a man who desires to build a small dam to be used for logging or other purposes would have to secure permission from Washington. In my opinion, the interpretation of the conference bill would make this necessary even if the development were contemplated on the smallest of streams, if by any chance they empty into a river that is navigable."

Objection to Government Development of Super-Power Zone

WHEN the item of the sundry civil appropriation bill carrying $125,000 for a survey of power production and distribution along the Atlantic Coast came before the House of Representatives at Washington objection was made by Representative McKeown on the ground that this development should be conducted by private enterprise and not by the government. The item was strenuously defended by the chairman of the appropriations committee, Representative Good, and by Representative Byrns of Tennessee. The latter is the ranking Democrat on the committee. In the course of his remarks on the subject Chairman Good said:

"We may smile at this proposition. We may laugh it out of Congress just as we did by ridicule the proposition of Mr. Langley in regard to the aeroplane. I say to you that it has within it the very things we must adopt to utilize these forces and to make a greater use of coal at the mouth of the mine and at tidewater. At the same time it would open up a plan whereby private capital, not government appropriation, would be used. I would not be in favor of appropriating a single dollar for the government to go into that kind of a scheme. Private capital should do that. When there is so much of wildcat and watered stocks being circulated and sold, how far would you get in promoting a company of this kind that had back of it only the estimate of some private individual or company? It is intended to have a government survey and a report, something that would have the stamp of the government officials on it."

Representative MacGregor of New York objected to the item on the ground that he sought to have incorporated into the water-power bill a provision requiring that power developed at Niagara Falls be distributed equitably to the industries of that vicinity. That provision was rejected by the House, which held that Congress had no right to dictate to the states as to the manner in which the power developed within the states is to be distributed. Only a few days after that action, Mr. MacGregor declared, Congress is appropriating money looking to exactly that end. A vote was taken on the question of retaining the item in the bill and but few votes were cast against it.

Proposal to Amend I. E. S. Constitution Placed Before Members

PROPOSALS to amend the constitution of the Illuminating Engineering Society and the nominations for national and section officers for the year 1920-1921 have just been placed before the members of the society for a letter ballot. There are five proposed amendments to the constitution.

The first amendment is to create a new class of members, to be known as student members, by doing which the officers of the society state they feel the society would be extending its usefulness and at the same time providing for future growth.

The second amendment provides for affiliates, in order, the officers state, that non-members may be interested in the activities of the society, especially in connection with the proposed local chapters.

Amendment No. 3 provides for increased dues to meet rising costs. In this connection the officers state that the society has an opportunity to do exceptionally good work, but it cannot keep up the effective work of past years with its present income. The changes would raise associate members' dues from $5 to $7.50; members' dues from $10 to $15 and sustaining members' maximum dues from $250 to $500.

The fourth amendment provides for local chapters, which would be something smaller and less formal than a section.

The last amendment would make amendments to the constitution effective Oct. 1 instead of twenty days after adoption.

Associated Manufacturers to Meet at New London in June

ALL sections of the Associated Manufacturers of Electrical Supplies will hold their regular summer meetings and the board of governors will holds its June meeting at the Griswold, Eastern Point, New London, Conn., June 26 to 30 inclusive.

Standing committees of the association for 1920 have been announced as follows:

Membership Committee — J. H. Trumbull, chairman, Trumbull Electric Manufacturing Company; W. E. Barker, United States Rubber Company; Russel Dart, Alphaduct Company; A. H. Englund, Electric Service Supplies Company; Edward Sawyer, Atlantic Insulated Wire & Cable Company; M. H. Sigafoos, Hazard Manufacturing Company; W. E. G. Mitchell, Mitchell-Rand Manufacturing Company.

Finance Committee—W. H. Thornley, chairman, Tubular Woven Fabric Company; Charles L. Eidlitz, Metropolitan Electric Manufacturing Company; E. B. Hatch, Johns-Pratt Company; B. E. Salisbury, Pass & Seymour, Inc.; J. E. Way, R. Thomas & Sons Company.

Law Committee—W. H. Thornley, chairman, Tubular Woven Fabric Company; D. R. Bullen, General Electric Company; Le Roy Clark, Safety Insulated Wire & Cable Company.

Entertainment Committee—Le Roy Clark, chairman, Safety Insulated Wire & Cable Company; Frank V. Burton, Bryant Electric Company; J. W. Perry, H. W. Johns-Manville Company; Edward Sawyer, Atlantic Insulated Wire & Cable Company; Charles E. Dustin, general secretary, and the president, ex officio.

Special Committee on Section Activities—D. R. Bullen, chairman, General Electric Company; W. H. Thornley, Tubular Woven Fabric Company; Le Roy Clark, Safety Insulated Wire & Cable Company.

Special Committee on Nomenclature—J. H. Trumbull, chairman, Trumbull Electric Manufacturing Company; John J. Gibson, Westinghouse Electric & Manufacturing Company; Shiras Morris, Hart & Hegeman Manufacturing Company.

Solution of Utility Credit Situation Is Local Investment, Says Banker

THAT the public utilities, struggling "between the upper millstone of regulation and the nether millstone of rising costs of operation," can attract new capital and offer a safe investment only by creating a genuine and effective interest among their customers and the people in the territories they serve was asserted by George L. Burr, manager of the bond department of the Guaranty Trust Company of New York, at the annual convention of the Southwestern Electrical and Gas Association, held this week at Galveston, Tex.

"It is generally felt among investors," Mr. Burr declared, "that many public utility companies have not had the public support which is due to them as honestly and ably managed public servants and that the problems of these companies and the just deserts of their owners and creditors have not been appreciated by the public bodies. It is therefore feared by many that, as a result of the combination of these circumstances and the rising costs of operation, financial disaster for many companies may be just around the corner in the shape of possible disappearance of 'net after taxes.'

"Compare on any such basis the case of the public utilities with the flexible earning power and favorable current asset position of an industrial company and it is not difficult to understand why it is almost impossible today to finance any but the exceptionally fortunate public utilities.

"That the characteristics of industrial investments are not necessarily the only basis upon which money can be obtained is shown by the sale of foreign government obligations and the bonds of our own states and municipalities and of some of our public utilities. I believe that if the investor can be shown that a public utility obligation will be paid, principal and interest, and that there will continue to be a good market for it, he will buy it; but he has taken many heavy losses in this type of investment and has very properly grown to be a discriminating person. Investment bankers, in protecting his interests as one of their customers, have exerted every effort to help him in his powers of discrimination, but also they have always been and still are equally ready to help utilities on any basis that is fair to their clients.

"It is not necessary for us at this time to consider the details of a company's corporate structure, the proportion of its debt to its total capitalization or the ratio of its earnings to its fixed charges. But I would like to call attention, as emphatically as I am able, to the fact that the gates to new capital are virtually closed to public utility companies whose customers and the people in the territories which they serve do not take an intelligent and effective interest in them, but regard them as outsiders and not as integral parts of their communities which must be fostered and developed as much as any other industry.

"It is not necessary that a company's requirements be financed entirely in this manner, but it is in many cases essential that there be on the part of the community served a sufficiently large good faith investment in its stock and debt to assure outside investors that the company will receive the same consideration as the other home industries in the territory which it serves."

Activities of Power Club Broadened

Board of Governors at Chattanooga Meeting Decides to Employ Secretary and Establish Central Headquarters—Sections Report on Work

JAMES BURKE
Re-elected President Electric Power Club

ABOUT 125 members and guests, including 25 ladies, attended the annual meeting of the Electric Power Club at Chattanooga, Tenn., May 5 to 8. The program, which called for four days of meetings, was made up of morning sessions on each day and evening sessions on the first two days. All were general meetings to which members, guests and others interested were invited following the plan of the club to hold no meetings behind closed doors. In addition to these general meetings, at which the work of special committees and sections was discussed, the various sections of the club held independent meetings on the second day. This was the first annual meeting since the adoption at Hot Springs, Va., last year of the section form of organization covering other groups of electrical apparatus than motors and generators. The creation of the storage-battery section this year out of the original mining and industrial locomotive section now brings the total of organized sections up to ten under the following designations: (1) Transformer section; (2) industrial control section; (3) power switchboard and oil circuit-breaker section; (4) motor and generator section (not including turbo-driven apparatus); (5) turbo-driven apparatus section; (6) storage-battery section; (7) electric welding section; (8) electric furnace section; (9) portable electric tool section; (10) electric measuring instrument section.

CHANGE IN NAME SUGGESTED

At the general meeting on the evening of the second day of the convention a suggested change in name of the Electric Power Club was brought up for discussion. Owing to the fact that the work now being conducted is of a broad engineering character, covering many phases of the electrical industry, and includes matters of standardization and application of other equipment than motors and generators, which was its original function, it was the feeling on the part of some members that the name "club" should be eliminated from the official title and some more comprehensive designation substituted. The name "Associated Manufacturers of Electrical Apparatus" was proposed, and after some discussion it was voted to refer this matter to the board of governors for further deliberation and report at a future meeting.

It was decided at this meeting and announced by the board of governors that, owing to the additional work created by extending the scope of the club to include section divisions, a paid secretary will be employed at an early date and official headquarters established at some central point.

The following reports of committees and sections were presented in printed form: Underwriters' committee; wiring committee; wiring and industrial locomotive section; fractional-horsepower-motor committee; large power-motor committee; generator committee; transformer section, and tariff committee. The reports of other committees consisted of brief outlines of the work done and in progress.

MORE COMPLETE COST DATA NEEDED

In presenting the report of the foreign trade committee and the tariff committee, S. L. Nicholson as chairman drew attention to the lack of data on manufacturing costs and emphasized the need for full knowledge of material and labor costs in each line of equipment made. This information is essential in order to be able to offer goods in foreign markets on a competitive basis. While the cost of labor in foreign countries, particularly in Japan and Germany, is much lower than in the United States, he showed that the productivity of labor is likewise lower. However, European countries are now installing labor-saving devices, so that this advantage in favor of American manufacturers is being rapidly eliminated. He said also that there is a need for a change in the basis on which tariff valuations are made so that the assessments will be on American instead of foreign values. The committee is to continue its study of foreign conditions and the economic needs of the electrical manufacturing industry.

Mr. Nicholson also outlined in considerable detail the work of the Electrical Manufacturers' Council, referring to the article which appeared in the ELECTRICAL WORLD of May 1, page 1002. At this time it was announced that the Electrical Manufacturers' Council will maintain a foreign trade bureau at its executive headquarters, which will shortly be established in New York City.

At the annual banquet of the club Harry F. Atwood of Chicago spoke on "Our Constitution the Antidote for Bolshevism." His plea was to return to a strictly republican form of government and the true interpretation of the Constitution as a code of government by the people and for the people. This, he contended, is the solution for industrial unrest and a correction of the tendency toward mob-mindedness and retrogressive tendencies.

At the final meeting of the board of governors, on the last day of the convention, the present officers of the club were re-elected for another year as follows: President, James Burke, Burke Electric Company; Erie, Pa.; vice-president, A. L. Doremus, Crocker-Wheeler Company, Ampere, N. J.; secretary, C. H. Roth, Roth Brothers & Company, Chicago; treasurer, R. J. Russell, Century Electric Company, St. Louis, Mo. Four mem the club were re-elected for another year as follows: R. J. Russell, Century Electric Company, St. Louis; T. E. Barnum, Cutler-Hammer Manufacturing Company, Milwaukee, Wis.; C. L. Collens, 2d, Reliance Electric & Engineering Company, Cleveland, Ohio; C. H. Roth, Roth Brothers & Company, Chicago.

The re-election of Mr. Burke as president is a recognition of his unselfish devotion to the work of the club during the past year and his constructive thinking and leadership under the new plan of organization and the growing importance of the section idea.

The next meeting of the club will be held at Hot Springs, Va., during the latter part of October or the first of November, according to which date offers better arrangements for accommodation. The exact time will be announced later.

Insull Analyzes Utility Credit Situation

TWENTY million dollars is needed by the Commonwealth Edison Company for essential plant extensions and betterments during the next two years, Samuel Insull, president of the company, testified at the recent hearing before the Illinois Public Utility Commission on the credit situation faced by the utilities of the state. All the utilities of Chicago, it was pointed out, should spend in the aggregate about $80,000,000 before the end of 1921. However, Mr. Insull said, they have been unable to get the funds in spite of the fact that it would take about twice as much money as was criginally invested in their properties to duplicate them today.

The Commonwealth Edison Company has never passed a dividend on its stock, but the testimony showed that it has difficulty in getting money at any price, and unless money is forthcoming the company cannot respond to the needs and growth of the community.

Mr. Insull could not explain why a utility as strong financially as the Commonwealth Edison Company could not borrow capital on an even basis with industrial companies except by saying that the general attitude of the investing public toward utilities affects those with the best as well as the poorest credit ratings. He said that conditions would be much better if the press would give public utilities the co-operation and support to which a business of such magnitude and public importance is entitled. Mr. Insull thought the commission would either have to allow an increased return to cover the price the utilities would have to pay for money at the present time or else make rates high enough to leave a sufficient margin to make extensions out of earnings.

Stoker Manufacturers to Meet at Lakewood, N. J., Next Week

ON TUESDAY, Wednesday and Thursday of next week the Stoker Manufacturers' Association will hold its annual meeting at Lakewood, N. J. A complete program of entertainment, including golf, motor trips and horseback riding, has been prepared for each day. The meeting will be opened Tuesday morning, May 18, by President P. A. Poppenhusen of the Green Engineering Company with an address on "The S. M. A.—Past, Present and Future." This will be followed by an address by S. A. Armstrong of the Underfeed Stoker Company of America on "Development of Stoker Organizations from the Standpoint of Ideals and Ethics." A business session will be held in the evening, at which reports will be presented by the commercial committee, P. A. Poppenhusen chairman; the public policy committee, S. L. Nicholson chairman, and the traffic committee, A. V. Pope chairman.

On Wednesday morning, May 19, reports will be made by the engineering committee, F. H. Daniels chairman, and the membership committee, J. H. Roach chairman. Henry Kreisinger, bureau of mines, Pittsburgh, Pa., will present a paper on the "Relation Between the Combustion Space and the Efficiency of Combustion." J. G. Worker will also lead a discussion on the question, "How can each individual stoker manufacturer give better service in furnishing stoker repair parts, with methods for building up this part of the business?"

On Thursday morning, May 20, A. R. Manjer, Chicago, will speak on "Advertising and How It Can Be Done by an Association," followed by reports of the publicity committee, R. C. Beadle chairman; cost-accounting committee, A. G. Pratt chairman, and entertainment committee, R. C. Beadle chairman.

Duty of the Industry to Participate in Public Works, Says Arthur Williams

SPEAKING at the monthly luncheon of the New York Electrical League on May 11, Arthur Williams, general commercial manager of the New York Edison Company, who during the war was food administrator for New York City, urged those associated with the electrical industry to lend their efforts toward the reconstruction problems now facing the country. Mr. Williams stated that he believed the time had come for the electrical men to get back into public thought by service to the public.

Being particularly fitted by training and environment to visualize the future, Mr. Williams held that they should take their places in public work. He pointed out that the country is confronted by many important problems, for the solution of which adequate methods have not been offered. Among these problems he mentioned that of the establishment of relations with the European countries with which we were recently at war.

Mr. Williams also made a plea for mutual understanding and intelligent co-operation between capital and labor, pointing out that labor must receive a fair wage, for which there must be a fair return in production. With this end in view partnership of capital and labor is already in successful operation in many instances. He said that those engaged in the electrical industry could be of great assistance in spreading this idea in their own and other industries.

Public Does Not Understand, Says Aylesworth

REGULATING commissions, M. H. Aylesworth, executive manager of the National Electric Light Association, declared at a luncheon in Boston on April 29, under the auspices of the New England Section, are well informed as to the issues facing the utilities today, but without a popular appreciation of the part the utilities are playing in modern life and correct ideas as to their prosperity and costs the whole scheme of commission regulation must fall far short of what is needed.

"Today we have an intelligent, honest body of public utility commissioners," said Mr. Aylesworth, "but the public itself does not understand the conditions under which the companies work, and for the reason that agitators have too long proclaimed the false doctrine that the utilities are robbing the people. We have on our part made the mistake of pulling down the blinds and waiting for the storm to subside, then going out into the streets and blushing as though we had been doing wrong!"

It is the intention of the association to change this condition henceforth, and the speaker outlined the work of the committee on public information, which has already had such good results in newspaper relations. Seven states have already organized under the guidance of the association a definite program for publicity, and to this effort a nation-wide scope will be given.

Market Economics Outlined

Electrical Supply Jobbers' Meeting This Week at Del Monte, Cal., Hears of Methods Employed in Different Sections of the Country

THE regular semi-annual meeting of the Electrical Supply Jobbers' Association was held on Tuesday, Wednesday, Thursday and Friday of this week at Del Monte, Cal. Most of the delegates from the Eastern and Central divisions of the association arrived on a special train and were welcomed on Monday afternoon at Sacramento, and all the rest of the week when not in session the convention delegates were entertained in Western fashion by members of the Pacific Coast Division. The first session was devoted to an illustrated lecture on the water powers and electrical features of the Pacific Coast by Robert Sibley, editor of the *Journal of Electricity*.

Meetings of the three divisions were held on Tuesday morning, and a joint session of all divisions was held in the evening. A. M. Little of Syracuse, N. Y., chairman of the Atlantic division, spoke of the desirability of each company charting its organization, and a committee was appointed to report on the fundamentals of organization for smaller companies.

Jobbing Practice in Different Sections

C. C. Hillis, chairman of the Pacific Section, showed how jobbing on the Pacific Coast differs from jobbing in other sections of the country, owing to distance from manufacturing centers. On the Pacific Coast jobbers carry larger and more diversified stocks. Direct shipments are unheard of and closer co-operation prevails than elsewhere. Moreover, business is conducted on a net price basis and not on lists and discount. Manufacturers are not encouraged to quote jobbers' prices nor to take orders and turn them over to jobbers to fill. Stocks are interchanged between jobbers and every encouragement is offered to dealers.

F. D. Van Winkle of Cincinnati spoke of the jobbing conditions in the Middle West and showed some samples of advertising done by his company. E. W. Rockafellow of New York reported on the dry battery, flashlamp and conduit situations.

Addressing the Central Division, C. W. Banta, vice-president of the Wells-Fargo National Bank of San Francisco, said on the subject of the present business and financial situation:

"Manufacturers are just commencing to realize that cost, intrinsic value and the price dictated by the supply are not such powerful factors in the maintenance of the price level as are the dictates of the public mind. This state of mind is already apparent in the case of the clothing industry and in the shoe business.

"A most important recent development of the general situation is the decision of the Federal Reserve Bank of Kansas City to adopt the Phelan plan of graduated discount rates; this plan will accomplish its purpose of curbing extensions and speculation.

"There has always been enough money to care amply for the demands for the necessaries of life, and there is always some surplus for the discovery and developments of new human comforts. We can expect to see a tendency toward lower prices start with declining food price levels. This should be ample warning when it comes.

"For my part," said Mr. Banta in concluding, "I cannot help siding with those moderates who feel that the present year should be a good one in business and that it will take at least another year so to clarify the situation that lowered costs and lessened demand will allow competition to work out its course in lower prices. With the return of a real price level, incompetent, inefficient businesses are going to be eliminated from the business body. The key to the solution of all our problems lies in co-operation. Get co-operation by all means, both inside and outside your organizations, and drag into the light of knowledge every unprofitable practice.

L. L. Hirsh, Electric Supply Company, New Orleans, read a paper entitled "Should the Jobber Receive a Better Profit?"

On Thursday F. A. Wilson-Lawrenson of the Union Carbide & Carbon Corporation addressed the convention on business distribution, outlining a quota plan of sales through jobbers, who in turn appoint the distributers. J. M. Wakeman of the Society for Electrical Development spoke on the aims of that organization. At the Thursday evening session W. L. Goodwin made an interesting address on business opportunity.

Friday's session was devoted to the California Electrical Co-operative Campaign, which was explained by L. H. Newbert. Interpretations were made as follows: "The Jobber's Viewpoint," by D. E. Harris of San Francisco; "The Contractor-Dealer's Viewpoint," by C. L. Chamberlain of the California Association of Electrical Contractors, and "The Manufacturer's Viewpoint," by Garnett Young of San Francisco.

A feature of the entertainment was an old timers' "forty-nine" camp on Wednesday evening, when the entire Pacific Coast delegation was attired in appropriate costumes, and a grand ball on Friday night.

The entire executive committee of the association will attend the convention of the National Electric Light Association at Pasadena next week.

W. L. R. Emmet to Receive Edison Medal Next Friday Night

NEXT Friday night at the annual business meeting of the American Institute of Electrical Engineers to be held in New York the Edison medal will be presented to W. L. R. Emmet, to whom it was awarded "For inventions and developments of electrical apparatus and prime movers."

At this meeting the board of directors will make its annual report, including a financial statement for the year ended April 30, 1920. The report of the tellers will also be presented, giving the results of the election of officers for the ensuing administrative year.

Immediately following the business meeting the ceremony of the presentation of the Edison medal will take place. This medal was founded by the Edison Medal Association, composed of associates and friends of Thomas A. Edison, and is awarded annually by the American Institute of Electrical Engineers "For meritorious achievement in electrical science, electrical engineering or the electrical arts."

The presentation ceremonies will be as follows: "The Edison Medal," by Carl Hering, chairman Edison medal committee; "Achievements of W. L. R. Emmet," by H. W. Buck; presentation of the medal by Calvert Townley, president A. I. E. E.; response by W. L. R. Emmet.

Owners of Dual Service Not Obliged to Set Electric Profits Against Gas Loss

THE fact that the Consolidated Gas Company of New York City also controls the New York Edison Company and the United Electric Light & Power Company has no bearing on the suit of the former company to have the 80-cent rate imposed by law set aside as confiscatory, in the opinion of Abraham S. Gilbert, to whom, as special master, the federal district court referred the case. "The complainant company," said Mr. Gilbert in his report filed with the court last week, "appears entitled to have the rate chargeable by it for gas kept adequate without regard to the rate charged for electricity by companies in which it owns stock control. Moreover, the Legislature has seen fit to provide separate regulation of gas and electric lighting companies."

Mr. Gilbert sustains the Consolidated Gas Company in its contention. If the court approves the finding the city will appeal, and the case will go through the circuit court of appeals and thence to the United States Supreme Court for a final decision.

Boston Utilities Co-operate with City in Fire Protection

CONTRACTS between the city of Boston, the Edison Electric Illuminating Company and the Boston Elevated Railway have been agreed upon in connection with the operation of a high-pressure fire service system begun eight years ago with a municipal loan of $1,000,000. The completion of this system has been delayed through various changes in administration, the earlier city authorities having been severely criticized for their failure to carry the work to a conclusion, but Mayor Peters states that in six months the installation will be in active operation. In the earlier plans it was proposed to place electrically driven pumping equipment on Boston Common, on the Charles River Esplanade and in the North End. Considerable progress has been made in the installation of the underground piping and hydrant system. By the terms of the contracts now agreed upon the Edison company and the railway company will house the pumping machinery in their own plants, supervise its operation and attend to its maintenance.

At the Atlantic Avenue generating station of the Edison company two multi-stage centrifugal pumps of a capacity of 3,000 gal. (1,135 l.) per minute each will be installed this year, space also being provided for a third. Two similar pumps will also be installed later in the Stuart Street substation of this company in the heart of the Back Bay district. Each of these pumps is to be driven by a direct-current motor, and storage batteries at these locations will furnish a temporary emergency supply of energy. At the Lincoln power station of the railway company two steam-turbine-driven pumps will be installed, with space for a third, all of 3,000 gal. per minute capacity against 300 lb. per square inch (21 kg. per sq.cm.) pressure.

At each of these stations the city will pay the utility a fixed charge of $200 per month for rental, the space required at Lincoln power station being about 20 ft. x 48 ft. (6 m. x 14.6 m.). At this plant a fuel charge will be made consisting of 24 cents per 1,000,000 B.t.u. (whether coal or oil is burned), with coal at $4.80 per ton and fuel oil at 0.92 cents per barrel of 42 gals. (158 l.), plus a labor and material charge of 10 cents per 1,000,000 B.t.u. For coal or oil at higher prices proportional readjustments will be made in the fuel charge. The regular Edison power rates will be applied to the service at the Atlantic Avenue and Stuart Street installations. Contracts will shortly be let for the motors, control and switchboard equipment for the two water-front installations.

Public Utility Burdens Must Be Lightened, Says New A. A. E. President

LEROY K. SHERMAN, president of the United States Housing Corporation, who was also elected president of the American Association of Engineers at its sixth annual convention, held at St. Louis on Monday and Tuesday of this week, thus summarized in his inaugural address the problems that confront the engineering profession:

"In our relations to the public there are many important matters pending: The equitable compensation of engineers in municipal and railway service; the engineers' license law; a national Department of Public Works; the enactment of modification of proper building laws and laws regarding reclamation and public improvements; the question of professional ethics involved in outside work undertaken by public employees or officials. It should be our duty to aid in the solution of problems involving relations between the public and the various utility companies which are fundamentally engineering works. For example, the removal of onerous burdens on public utility companies which increase cost of operation without resulting in an improvement to the service. The public utilities companies may have sinned against the public in the past; now they have suffered the penalty and they are entitled to redemption."

California Electrical Co-operative Campaign on Larger Scale

A SECRETARY, three field representatives, an architectural representative, an advertising representative and an office assistant, making a total staff of seven, are to be employed in 1920 by the California Electrical Co-operative Campaign, according to the second annual report of that enterprise recently issued by the advisory committee, of which Lee H. Newbert, manager of the commercial department of the Pacific Gas & Electric Company, is chairman. To finance the undertaking a budget of $27,000 has been provided, 90 per cent of which has already been pledged by various organizations in the following proportions per centum: Power companies, 35; manufacturers, 29; jobbers, 23; contractor-dealers, 12; technical press, 1.

The sum named is nearly $10,000 more than the sum raised by subscription for 1919. Receipts from all sources for that year were $23,476 and expenditures $18,809, leaving a balance of $4,667. The assistance in merchandising given to contractors and dealers in 1918 and 1919 is summarized in the following table:

	1918	1919	Total	Contemplated
New stores	12	67	79	8
Better locations	21	49	70	10
Remodeled stores	13	50	63	15
Total	46	166	212	33

The number of electrical solicitors in California has been tripled in two years' time, fifty-seven electrical dealers have adopted the standard accounting system of the National Association of Electrical Contractors and Dealers, a system of sales bonuses has been worked out, newspaper advertising has increased 400 per cent, membership in the State Association of Electrical Contractors and Dealers has grown, and a salesmen's auxiliary to the co-operative campaign has been organized.

The advisory committee will continue during 1920 its educational advertising and co-operative work along the same broad lines as in the past, giving special attention to the problems of the contractors and beginning active work with the architects, builders and owners.

Chamber of Commerce Taking Vote on Public Works Department

IN ORDER to ascertain the sentiment of the business men of the country with respect to the proposed federal Department of Public Works, a referendum is being taken by the United States Chamber of Commerce. The three proposals of the referendum follow:

1. Shall a Department of Public Works be established by the national government?
2. Shall a Department of Public Works be established by a suitable modification of the existing Department of the Interior, excluding therefrom the non-related bureaus and offices, and by change of name from Department of the Interior to Department of Public Works?
3. Shall a Department of Public Works be established by creation of an entirely new department?

Central Maine Hydro-Electric Merger and Interconnection Approved

THE Maine Public Utilities Commission has issued a decision approving the acquisition by the Central Maine Power Company of control of the Androscoggin Electric Company, the Knox County Electric Company and the Oxford Electric Company, thus sanctioning one of the most important hydro-electric centralization plans proposed in New England in recent years. As recently stated in the ELECTRICAL WORLD these properties will be operated in a single interconnected system.

The Central Maine company has rights in nine of the sixteen counties of the State, serving nearly ninety cities and towns. The Androscoggin company has a light and power business in Auburn and Lewiston, also owning and operating an interurban electric railway between Lewiston and Portland. The Knox County company does a light and power business in Rockland and adjoining territory, and operates a street railway between Warren, Rockland and Camden, purchasing energy from the Central Maine company. The Oxford company does a light and power business in South Paris, Norway and Mechanic Falls.

The commission finds that the rapid growth of Lewiston and Auburn and of the territory of the Androscoggin company in general can be better served through the tying in of the systems than through sole reliance upon plant expansion on the Androscoggin River, limited as it is in comparison with the facilities to be co-ordinated through interconnection and centralized control. The new plant of the Central Maine company under construction at Skowhegan will provide a surplus of energy which can be utilized to advantage on the other parts of the co-ordinated system.

Engineering Is the Foundation for Progress in Electrical Industry

TOO little appreciation exists at present of the dependence of the electrical industry upon engineers, especially among undergraduate students looking forward to an early entrance into business and professional life. Richard H. Rice, manager of the Lynn works of the General Electric Company, emphasized this point recently before the Harvard Engineering Society, stating that the volume of business in each branch of manufacture runs parallel to development work by the designing engineers. If the flow of new ideas subsides, the orders for the particular class of apparatus concerned almost immediately begin to decrease. Most of the executives of the company represented by Mr. Rice have attained their posts as engineers via the test-room and drafting-table route, and the more commercial tasks are taken up only after a preliminary experience in the technical side of the art. There is a mistaken feeling among young men to the effect that engineering design offers few opportunities for financial advancement, but there is no short cut to commercial success in industries resting upon so technical a base as applied electricity.

Belief Expressed in Electric Welding for Future Shipbuilding

ALTHOUGH progress will be slow, eventually ships will be fabricated by electric welding instead of by riveting. Such was the prophecy expressed at recent meetings of the Philadelphia Section of the American Institute of Electrical Engineers and the American Bureau of Welding. It was admitted that the efforts of the Shipping Board during the war had not been successful up to the armistice, when the experiments on three large spot welders were discontinued, but the idea has not been given up.

To show their belief in the ultimate success of replacing rivets by welding, the Baldwin Locomotive Works of Philadelphia have offered $10,000 for experiments along this line and other firms have offered contributions. Prof. Comfort A. Adams of Harvard University, in his talk at Philadelphia, showed pictures of two foreign boats that had been welded and which had stood rough service successfully.

Saving of $2,000,000 in Fuel Oil from Hydro Development

TO PROVIDE for the construction of hydro-electric plants which when placed in operation will effect a saving of $2,000,000 annually in fuel-oil costs alone, the Pacific Gas & Electric Company of California is issuing $10,000,000 five-year 7 per cent collateral trust gold notes, due May, 1925. These notes are being placed on the market at 97½ and interest, yielding about 7.7 per cent and at the option of the holder are convertible into the company's preferred or common stock.

Proceeds from the sale of these notes, it is stated by A. F. Hockenbeamer, second vice-president of the company, will also be invested in transmission and distribution facilities in addition to the hydro-electric development on the Pitt River, where the installation of the first 20,000-hp. unit is now under way, and it is expected that energy will be delivered by Jan. 1, 1921.

A "No Accident Week" to Help the Cause of Safety in Utilities

AN ADDITION to days and weeks devoted to special objects is the "no accident week" set aside by public utility interests of New York and Pennsylvania for the observance of an "accident-prevention drive." E. R. Dobbin of the Empire Gas & Electric Company, Geneva, N. Y., is the chairman and G. R. Rinke, 5 Nassau Street, New York City, the secretary of the 1920 safety committee, having the plan in hand. The second week in June is the period selected. A similar effort made last November under the name of "safety week" had excellent results in accident reduction.

An attractive colored poster and six daily bulletins, as well as an artistic button for coat lapels, will help to carry on the propaganda, which has the earnest support of the Buffalo General Electric Company, Harrisburg Light & Power Company, Niagara, Lockport & Ontario Power Company, Northern New York Utilities, Northwestern Electric Service Company, Rochester Gas & Electric Corporation, Western New York Utilities Company and the Wilkes-Barre Company.

Great Growth of the Local Stock Sale Reported by Standard Gas & Electric

AN OUTSTANDING feature of the 1919 report of the Standard Gas & Electric Company, which embraces thirteen subsidiary companies operated by H. M. Byllesby & Company in fourteen Western states, is its announcement of steadily increasing sales of the securities of its various constituent utilities to the public in their respective territories. These sales, says President Byllesby, are assuming such proportions that in some instances virtually all construction expenditures of the company concerned were met from their proceeds. Preferred stocks form the greater part of the securities sold in this way, and the growth in the number and value of sales since the latter part of 1915, when the plan was first tried, is as follows:

Year	Sales	Shares, Par Value	Average Par Value per Sale
1915	326	$206,300	$632.82
1916	2,039	1,146,800	562.46
1917	3,305	1,700,100	514.40
1918	4,923	2,419,400	491.44
1919	5,723	3,421,900	597.91
Totals	16,316	$8,894,500	$545.12

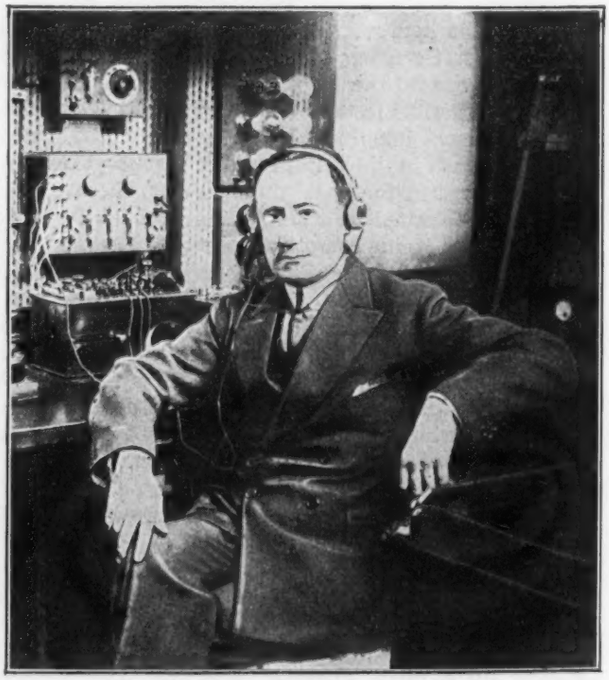
"It will be seen," the report continues, "that the average sale amounts to slightly less than six shares. Permanent financing of this character, relieving the companies in no small way of the necessity of providing from time to time for maturing obligations, has greatly strengthened the financial structure of your subsidiaries. In addition to the $3,421,900 par value of preferred stock sold locally in 1919, $1,429,200 face value of other securities was sold in the same manner in the same year. The benefits accruing to your respective subsidiaries, as well as to their respective customers, from such extensive and increasing 'customer ownership' are so manifest as to require no further comment, and the growing popularity of this movement may be gaged by the fact that local sales of preferred stock during the first quarter of 1920 amounted to $2,597,600 par value, equivalent to 76 per cent of the entire 1919 sales."

The Standard Gas & Electric Company finished the year 1919 with the largest surplus in its history, amounting to 7.7 per cent on the common stock after payment of increased dividends on the preferred. The aggregate gross increase in earnings of subsidiaries amounted to $3,813,850, or approximately 16½ per cent, as compared with an increase of $4,002,698 in 1918.

Valuation and Combustion A. S. M. E. Spring Meeting Topics

THE spring meeting of the American Society of Mechanical Engineers will be held in St. Louis on May 24-27, with headquarters at the Hotel Statler. The elevator code drawn up as the outcome of several years' work by a committee of the society will be discussed at this meeting, and power and combustion topics, including stokers, pulverized fuel, feed-water heaters and feed-water treatment, will come in for review. On the opening day there will be an appraisal and valuation session, with discussion of the following papers: "Appraisal and Valuation Methods," by David H. Ray; "Fundamental Principles of Rational Valuation," by James Rowland Bibbins; "Data on the Cost of Organizing and Financing a Public-Utility Project," by the late F. B. H. Paine (contributed by Dean M. E. Cooley); "The Construction Period," by H. C. Anderson, and "Price Levels and Value," by Cecil Elmes. A visit on Sunday, May 23, to the Keokuk (Iowa) hydroelectric development and a trip to the Tulsa (Okla.) oil fields on May 27 have been arranged.

Marconi Investigating Origin of Radio Disturbances



FOR some time there has been considerable discussion relative to the origin of radio disturbances, and in an effort to clear up this scientific mystery William Marconi is now at sea in his specially fitted up yacht Electra, from which he is undertaking a series of experiments. This picture shows Signor Marconi seated in his wireless laboratory on board the Electra.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

A Central European Plan for Combined Canal and Power Development.—A scheme to connect the Rhine, Main and Danube Rivers by a waterway that would accommodate ships of 1,200 tons and at the same time permit the hydroelectric development of 100,000 hp. is reported as taking shape in Central Europe.

New Course in Communication Engineering at Harvard.—The Harvard Engineering School faculty has voted to establish a new undergraduate course in electric communication engineering, comprising the study of the telephone, telegraph, hydrophone and radio work. The curriculum will include existing studies in electrical engineering theory, machinery, transmission and power distribution and will utilize the Cruft radio laboratory and other facilities of the electrical department. Considerable work will be included in mathematical physics, and the course will fit students to enter the research field as well as that of engineering.

New Stock Issue for Great Western Power Company.—An increase of approximately 20 per cent in the cost of labor and material, unexpected and unforeseeable construction difficulties and a change in the power-house plans are the reasons given by the Great Western Power Company in an application to the California Railroad Commission for permission to issue $1,500,000 in stock. The company asserts that it will need the money raised through the proposed sale of the preferred stock to complete the Caribou power house on the north fork of the Feather River. According to the company's application, the plant will cost $1,924,670 more than the original estimate.

The British Electricity Bill.—A bill to amend the electricity supply act passed last session has been introduced into the British House of Commons. As amended, the bill is to include the compulsory clauses which were abandoned in order to insure the passage of the original measure, and it contains a clause providing for financial assistance to the extent of £25,000,000 by means of electricity bonds. This procedure, the London *Electrician* remarks, is objectionable to a number of strongly vested interests, and the government will need all its strength to push it through, although some financial powers must be given to the commissioners if a "cheap and abundant" supply of electrical energy is to be an accomplished fact within the near future.

Wireless Telephoning Over Long Distances.—Among recent successful European experiments in long-distance telephoning have been the transmission of a long message from Chelmsford, England, to Rome by the editor of an Italian newspaper, and tests between Berlin and Karlsborg, Sweden, a distance of 440 miles, and Berlin and Moscow, a distance of 1,000 miles.

Railway Tunnel Fans to Be Operated Electrically.—Until two or three weeks ago two immense fans employed to rid the Big Bend (W. Va.) tunnel of the Chesapeake & Ohio Railroad of gas and smoke were driven by steam power at the eastern end of the tunnel. Under the direction of J. M. Wilson, manager of the Virginia-Western Power Company of Hinton, W. Va., electric drive has been substituted, and the fans are now operated by two 350-hp. motors installed at the western end of the tunnel.

Lynn General Electric Employees Attack H. C. L.—A vigorous attack on the high cost of living was launched recently at the Lynn (Mass.) works of the General Electric Company, when a clothing store was opened under the direction of the Lynn General Electric Employees' Co-operative and Collective Buying Association. The organization is incorporated and capitalized at $100,000, shares at $10 each being sold only to employees of the company. Officials of the General Electric Company are not connected with the organization, although its plans are heartily approved and space in the works buildings has been set apart for the store. Overalls, haberdashery, suits and shoes will form part of the stock in trade. In the near future another organization of employees will be incorporated to sell foodstuffs under the direction of the Metal Trades Council of the General Electric Company.

Metric System Not to Be Favored in the Army.—Confusion in the army arising from the increased use of metric units of weight and measure has prompted the Secretary of War to order the use of British units wherever practicable. His instructions are as follows: "Hereafter the customary former units of weight and measure (including the degree Fahrenheit) will, as far as practicable, be used throughout the army as they were before the war. Material and equipment now graduated in metric units will when worn out be replaced by articles graduated in British units in such manner as will cause all parts of a regiment or similar organization (or smaller organization when there is no regimental organization) to be provided at all times with material and equipment graduated alike. This order shall not be construed to prevent the utilization of metric units of weight and measure when desirable in connection with specifications and contracts, medical and scientific supplies, scientific research and developments, international meteorology, foreign maps, monographs, handbooks and similar subjects."

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

American Electric Railway Association.—The annual convention of this association has been fixed for Atlantic City, N. J., Oct. 11 to 15.

Business Meeting of A. I. E. E.—The annual business meeting of the American Institute of Electrical Engineers is to be held next Friday, May 21.

National Electric Credit Association.—The twenty-first annual meeting of this body will be held at the Hotel Commodore, New York, on June 17 and 18.

Industrial Relations Association of America.—The second annual convention of this association will be held at the Auditorium Theater, Chicago, on May 19, 20 and 21.

Society for Electrical Development Moves.—Headquarters of the Society for Electrical Development, formerly in the Engineering Societies Building, are now in the Guaranty Building, 522 Fifth Avenue, New York City.

Iowa Section, National Electric Light Association.—This section will hold its next annual convention at the Colfax Hotel, Colfax, Iowa, on June 23 to 25, inclusive. The convention will be a strictly business meeting, and managers of small independent companies have been specially urged to attend. Executives of the larger companies have also been requested to send their department heads and local managers. A consolidation of the Iowa Section with the proposed Middle West Geographic Division of the N. E. L. A. will probably be approved. Rex H. Fowler, 510 Crocker Building, Des Moines, Iowa, is assistant secretary.

A. I. and S. E. E., Philadelphia Section.—Officers elected for the ensuing year at the May 1 meeting of this section of the iron and steel engineers were: Chairman, A. J. Standing, Bethlehem Steel Company; vice-chairman, R. B. Gerhardt, Bethlehem Steel Company; secretary, L. O. Morrow; executive committee, Walter C. Kennedy and H. Cosdon. R. B. Gerhardt, in a talk on "Electrical Transmission in a Steel Plant," described the selective operation of relays in protecting the double-ring bus transmission system of the Bethlehem Steel Company's Sparrows Point plant. Other papers were: "Waste-Heat Boilers for Open-Hearth Furnaces," by T. R. Tate; "The Giant Pull," by G. W. Richardson; "Methods Used in Laying Out the Electrical Equipment for a New Steel Plant," by H. Cosdon, and "How the Accounting Department Can Serve the Operating Department," by R. F. Gale.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Early-Morning Lighting in Small Town.—The Public Service Commission of Missouri has decided that the proprietor of an electric lighting plant in Leeton, a town of 500 population, will not be required to furnish electricity between 4:45 a.m. and daylight from May to September, although the terms of his franchise so require, unless the patrons are willing to pay rates commensurate with such service.

Payments in Lieu of City Tax Must Be Prorated Among Customers Benefited.—The Idaho Power Company having agreed to pay to the city of Boise certain sums annually in lieu of a tax formerly paid in consideration of a franchise which has been canceled to obviate duplication of equipment, it has been held by the Idaho Public Utilities Commission that these payments must not be charged into general operating expenses but prorated among the company's Boise consumers.

Unprofitable Lines Ordered Continued.—The Public Service Commission of Nevada has denied the Nevada-California Power Company authority to discontinue operation of its electric power line from Lundy, Cal., to Nevada districts, excepting Fairview and Wonder. The company desired to withdraw service from Hawthorne, Mina and other southwestern Nevada points. The commission held that inasmuch as the company had used profits from its Nevada business to build a new line in California it would not be fair to abandon Nevada patrons because the service was less remunerative.

Right of Supply Company to Prescribe Types of Motor Denied.—The Illinois Public Utilities Commission has refused its approval to proposed rules of the Commonwealth Edison Company designed to raise the power factor of the company's system and to this end requiring future installations of motors rated at 100 hp. or more to be of the synchronous type and motors rated at 50 hp. or more, if operated at variable speeds or if normally started at frequent intervals, to be of the wound-rotor or slip-ring type. The commission having prescribed rules establishing standards and limits of voltage regulation, the consumer is held to be entitled to service which conforms to such standards and should be put to no extra expense to obtain this service so long as he is not unreasonable in his use of it. Consumers, the commission declares, are entitled to a direct benefit for the additional expense of installing synchronous motors.

Consumers' Economy May Benefit Electric Utility.—That the exercise of economy by consumers of electrical energy is often a benefit to the generating company is pointed out by the Wisconsin Railroad Commission in a decision permitting the Hayward Electric Light & Power Company to change its power rate from a flat to a meter basis. Economy by consumers, the commission says, "is to the utility a very important consideration both on account of the cost of extra generation and on account of loading down the generating equipment, which may mean the installation of additional equipment to take care of new customers. Another consideration enters into the case of hydraulic plants. During periods of low water the water used in generation may exceed the stream flow, in which case the load must be cut off in part or temporarily in entirety."

Centralization and Over-Development.—In authorizing the acquisition by the Central Maine Power Company of the Androscoggin, Knox County and Oxford companies, the Maine Public Utilities Commission made the following explanation of the principles governing its approval: "If a relatively small hydro-electric company is serving a fairly small community, the development of the facilities with which it renders service is likely to be expensive, and if it over-develops, as is natural in providing for future growth, this over-development has to be supported by the customers of the company and often results in a considerable burden. If additional power is desired and a new development has to be made, good judgment on the part of the company will require it to over-develop in anticipation of future business. The result is that each small company is likely to be carrying as a burden a fairly large amount of idle property which has to be supported by its customers until the time when a use therefor is found. If the company does not develop its own energy but purchases from a generating company and, as sometimes happens, the company from which it purchases is also a purchaser from another company, there is at least one profit, and sometimes two, that the last company has to pass along to its customers. Further than this, the character of the service rendered by a small company is likely to be not entirely satisfactory, the means for extensions are not always available or obtainable, the territory is frequently only partly served, and the rates charged are likely to be fairly high. On the other hand, if one financially strong company, with ample power or with reserve facilities from which ample power may be secured, is occupying a large territory, that entire territory gets the full benefit of the combined facilities, each part of the territory getting as good service as any other part. If a new development has to be made there is but one development, and there are no profits to be paid to outside generating companies."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Failure to Call Witnesses Construed Unfavorably.—Failure of a plaintiff public utility in a rate case to call available witnesses who could have testified as to accessibility of books, and who without them might have thrown light on the original cost of construction, justifies the conclusion that their testimony would have been unfavorable to it, the Supreme Court of New York recently asserted. (180 N.Y.S. 570.)

Boiler Room of Electric Plant Not a Place of Extra Hazard.—A fraternal benefit society having refused to pay a policy taken out by a man who subsequently changed his occupation without notice to the society and took employment as a fireman in the boiler room of an electric plant, the society's life certificates classifying "electric works" as places of extra hazard, the Texas Court of Civil Appeals ruled that where the boiler room was separated from the generating room by a partition and the fireman was not required to enter the generating room the contention that his employment was extra-hazardous could not prevail. (219 S.W. 492.)

What Constitutes Proof of Confiscation.—In denying the suit of the Kings County Lighting Company to have the legal rate of 80 cents for 1,000 cu.ft. for gas declared confiscatory, the Supreme Court of New York declared that unless the evidence is conclusive that confiscation is inevitable under a rate law a public utility attacking it fails to meet its burden of proof where it has made no practical test by actual operation under the prescribed rate; nor are rates fixed by law for a public utility necessarily confiscatory because for an abnormal year its income is thereby reduced below what would ordinarily be deemed an adequate return on the investment. (180 N.Y.S. 570.)

Crossing Street Diagonally and Failure to Observe Dangling Wire Not Negligence.—An employee of an electric light company while pursuing his duty was injured by coming into contact with a telephone wire which had come loose, fallen across a high-voltage line and was dangling five or six feet above the ground. The Supreme Court of Pennsylvania, in affirming a verdict for recovery of damages, held that the fact that the plaintiff crossed the street diagonally and failed to look up did not constitute contributory negligence, as any pedestrian has the right to cross a street diagonally and no one was obliged to anticipate danger from overhead wires. (109 A. 211.)

Men of the Industry

Changes in Personnel and Position—Biographical Notes

H. J. Butler, power administrator of the Railroad Commission of California, has recently been placed in charge of all of the power generated in that state. Prior to this Mr. Butler's activities were confined to the northern part of the state, but, owing to the shortage of power for the present year, it was felt necessary that the entire state should be under the control of one man. Mr. Butler has carried on the duties of power administrator since June, 1918. He was graduated from the University of Illinois with the class of 1906 and after graduation was connected with several railroads in the Middle West, including the St. Louis & San Francisco. In 1911 Mr. Butler went to Panama for the government, having charge of the railroad yards there during the canal's construction. At the completion of the canal Mr. Butler was called to the California Railroad Commission, acting in the capacity of assistant chief engineer until two years ago, when he assumed his present position.

H. J. BUTLER

M. Imai, consulting engineer for the South Manchurian Railroad of Northern China, is visiting this country making an investigation of high-head hydro-electric power development.

Howard S. Phelps, who was electrical engineer for the Iowa Railroad Commission, Des Moines, Iowa, has accepted a position in the engineering department of the Philadelphia Electric Company, Philadelphia.

J. C. McLaughlin, who for some thirty years has held the position of manager of the commercial department of the Potomac Electric Power Company, Washington, D. C., resigned May 1 to open an electrical retail store in Washington.

Walter A. Hall, who for twenty-two years had been connected with the Lynn Works of the General Electric Company and during recent years served in the capacity of assistant to the general manager, has resigned to become vice-president and general manager of the Murray & Tregurtha Company, builder of gasoline engines.

Louis H. Egan, who became vice-president of the Union Electric Light & Power Company of St. Louis last year, has been elected president of that company, succeeding J. D. Mortimer of New York, whose resignation was recently announced in the ELECTRICAL WORLD, as president of companies controlled by the North American Company, of which the Union Electric Light & Power Company is one. Mr. Egan was graduated from the Sheffield Scientific School of Yale University in 1904 and for about eighteen months thereafter worked for the Algoma Steel Company, Sault Ste. Marie, Ontario, as an electrician's helper. He then entered the central-station field and for the next five years worked in various engineering and sales capacities for the Edison Sault Electric Company and the companies affiliated with the Detroit Edison Company, finishing that period as division manager for the Eastern Michigan Edison Company. From 1910 until 1916 he was general manager of the Kansas City Electric Light Company and in November, 1916, became affiliated with the North American Company properties in St. Louis. Mr. Egan was first appointed general manager of the Electric Company of Missouri, and after that company was combined with the Union Electric Light & Power Company he was made assistant general manager of the combined properties. In the fall of 1919 he was elected a vice-president. Mr. Egan has also served as vice-president and general manager of the St. Louis County Gas Company, of which he also becomes president.

Fred H. Heimburg has been appointed assistant to the chief engineer of the Turners Falls Power & Electric Company, with headquarters at Greenfield, Mass. Mr. Heimburg was graduated from Columbia University in 1916 and has since been employed at the Schenectady works of the General Electric Company. He has been assistant to H. M. Hobart in general engineering work for the past sixteen months.

Warren G. Lewis, who for the last fourteen years has been electrical engineer of Knowlton Brothers, Inc., Watertown, N. Y., has been appointed superintendent of power for that company in charge of steam and electrical power service for the works. Charles Stebbins, recently electrical engineer for the Racquette River Paper Company, Potsdam, N. Y., has been appointed assistant superintendent of Knowlton Brothers, Inc.

William Cotton Lounsbury, general manager of the Superior (Wis.) Water Light & Power Company, who has been re-elected president of the Wisconsin Electrical Association, has been with the Superior Company for thirteen years. He graduated from the Massachusetts Institute of Technology in 1904 and after spending the next few years in Worcester, Mass.; Washington, D. C., and New York City, he took charge of all construction work for the Superior (Wis.) Water, Light & Power Company. In 1912 he was made general superintendent of the company in charge of the operation of the water, gas and electric departments and after making an enviable record reducing operating costs was appointed general manager in 1918. Mr. Lounsbury is a fellow of the American Association for the Advancement of Science and, in addition to being active in many associations connected with his business, he is serving his second term as president of the Superior Park Commission.

W. C. LOUNSBURY

Charles H. Carpenter, formerly manager of the Buzzards Bay Electric Company and well known in New England electric utility circles, has received the decoration of Officier d'Académie Française, in recognition of his services as lieutenant in the fourth section of the United States Army general staff, at the headquarters of General Pershing. Mr. Carpenter is the son of Eugene Carpenter, long prominent in the development and management of public utilities in the Cape Cod and White Mountain districts of New England. He is at present treasurer of the Mason Perkins Paper Corporation, Bristol, N. H.

William Milnes Maloy, Annapolis, Md., formerly State Senator from that district, has been appointed chairman of the Board of Public Service Comissioners of the state by Governor Ritchie. Mr. Maloy succeeds the late Milton Reifsnider.

George Rosenberger, Manassas, Va., has been appointed manager of the Herndon (Va.) Electric Light & Power Company.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Freight Tie-Up Causing Shut-Downs to Industry

ALTHOUGH the switchmen's strike had been declared ended, the after-effects of that tie-up have been much worse than were anticipated by manufacturers. Railroads report that they are handling freight in varying amounts up to almost normal, but manufacturers are finding little encouragement in these reports. Renewed yard walkouts are making the situation much more serious.

Material connected with the electrical industry is not moving in quantity to relieve the demand for it. In the steel-mill regions lack of coal, coke and raw materials has shut down furnaces and mills in many centers. Buffalo mills are reported at 60 to 70 per cent operation, while those in the Youngstown district are reported at less than 50 per cent normal. Conditions around Chicago mills are given as 75 per cent of normal, while Pittsburgh is placed as high as 90 per cent. If coal is not moved into these centers in greater quantity, it is expected that these values will drop. At the same time hundreds of coal mines are reported idle.

In the New York district there is a threatened shortage of coal. Already in Chicago the seriousness of reduced utility consumption of coal has been reported, and it is also felt in Detroit. The lake boats themselves are getting short of coal and are tying up at their docks idle.

While the railroads are apparently exerting all efforts to move coal and food, they are handicapped by lack of men, cars and locomotives. The facilities do not seem to be at hand to unscramble the mass of cars that have piled up in the yards. The Interstate Commerce Commission sets the normal functioning of the railroads under the best conditions at not under sixty days.

Active Demand for Farm High-Tension Substations

THROUGHOUT the central portion of the country, and in the West, the demand for high-tension switching substations for farm service has grown to be a real factor in the business. The demand is also good in Canada. In the East and South there has not been so much call for this service as these sections are not strictly farming districts. At the same time, these sections report that an increasing interest is being taken in this high-tension equipment, and orders are coming through fine.

In Canada, in particular, central stations have reported a marked increase in orders for this service, which could not be accepted because the station capacity was not available. Another reason given for the unfilled orders was the lack of utility finances to extend the lines where capacity was available and the indecision of the farmers as to the best methods of financing it on their part. They would prefer to buy the substation equipment outright, but were not in all cases able to do so.

Central stations in the Middle West are buying the substations outright from the manufacturer and reselling them to the consumers, sometimes for cash and at other times on some sort of a payment plan. In this connection it is found that farmers prefer lump payments over long terms of a year or so rather than on monthly instalment basis. So it seems that the method of payment has a great deal to do with the distribution of high-tension farm substation equipment. As far as could be learned there has been no definite policy adopted either by central station or by manufacturer in regard to this matter of payment.

Apart from the transportation delays which manufacturers are experiencing, shipments of this equipment are being quoted at from three or four weeks to five months. Factory conditions now are badly congested, and it is probable that still further delays will add to this shipping time. The demand in the Middle West is reported for sizes running up to 150-kva. units, while in the East it is rarely above 20 kva. Small farms in all sections, however, are averaging around 1 kw. for light load and may run up to 5 kw.

March Electrical Exports Far Ahead of February

IN SPITE of the foreign exchange situation the export of electrical goods for the month of March reached a value of $8,874,884. This is an increase of $2,291,656 over the month of February, 1920, and of virtually $1,000,000 over March of last year and is the highest amount exported since last June. Each succeeding month of the year has shown an increase over previous months, and the total amount for the first three months reaches a value of $21,805,549, as against $22,164,966 over the same period of 1919. The new year is starting off favorably when low exchange values to European countries are considered.

Manufacturers of electrical apparatus report an exceedingly heavy demand from outside the country. Those who have capacity reserved for foreign fields are having little difficulty in finding a ready market for every bit of material they can produce and move. Conditions of rail transportation are seriously affecting shipments to coast ports, and much material that does reach the coast is being held up by port loading and shipping strikes. This is an increasingly serious factor in the export field.

	March		Three Months Ended March	
	1919	1920	1919	1920
Batteries	$ 579 708	$ 690,866	$ 1,345,956	$ 1,592,568
Carbons	98,923	128,531	449,391	344,757
Dynamos and generators	390,765	464,178	1,028,063	1,240,811
Fans	269 934	115,069	567,463	224,436
Heating and cooking apparatus	151,693	135,450	321,344	389,289
Insulated wire and cable	1,025,867	543,546	2,541 178	1 772 424
Interior wiring supplies	172,622	230,315	578,589	594,718
Arc lamps	308	1,088	3,216	1,351
Carbon-filament lamps	14,039	19,986	50,738	36,865
Metal-filament lamps	426,128	427,348	1,407,682	1,002,436
Magnetos spark plugs, etc.	321,499	444,240	856,953	957,658
Meters and measuring instruments	273,373	207,655	853,272	615,242
Motors	838,448	1,247,806	2,626,598	2,807,355
Rheostats and controllers	38,565	72,896	103,443	177,936
Switches and accessories	225,305	356,631	592,133	1,031,870
Telegraph apparatus	60,186	61,530	246,323	261,684
Telephones	255,154	414,451	802,506	898,094
Transformers	449,077	347,195	1,159,699	992,744
All others	2,284,759	2,966,103	6,630,419	6,863,312
Total	$7,876,353	$8,874,884	$22,164,966	$21,805 549

The biggest increases noted in March over February of this year are in carbons, fans, arc lamps, magnetos, motors, telegraph and telephone apparatus and miscellaneous equipment. Exports of motors increased 50 per cent, while those of carbon-filament lamps doubled. The above items and batteries, metal-filament lamps and interior-wiring supplies have shown a steady increase each month this year.

The figures in the table above are by the Bureau of Foreign and Domestic Commerce and include, for the sake of comparison, the exports of March, 1919, as finally revised.

Heating Device Makers Issue New Price Lists

Prices were advanced this week by some of the leading manufacturers of household heating devices and ranges. The new lists include Hot Point price list No. 19, Hughes price list No. 23 and Edison price list No. 8. There are also revised price lists of the Simplex Electric Heating Company and heavy duty Edison equipment. These were all made effective May 10. A new price list of the Landers, Frary & Clark line is made effective May 15. In no case has the entire line been affected, but where there has been a change in the price of the socket appliances it has generally been an increase of 5 or 10 per cent. Six-pound household irons have been increased by 50 cents.

Car Tie-Up Reacts on Schedule Material Producers

MANUFACTURERS of schedule material are at present struggling to keep their factories going in face of extraordinary difficulties arising from transportation shortage. A representative of the ELECTRICAL WORLD last week visited a number of large Connecticut factories producing this class of goods and reached the conclusion that only by the exercise of executive far-sightedness and by a substantial improvement in railroad conditions can a shortage of considerable magnitude be forestalled. Of course it has been hard to obtain raw material. Labor, while less scarce than in many lines, needs to take up a deal of slack in production, and beyond this, greater facility in accomplishing outgoing shipments of finished products to all parts of the country is of vital importance. Continued strikes in railroad and marine circles hamper material movement badly, and while some improvement in the railroad situation was evident on Saturday, the contrast between normal and present-day transportation facilities remains acutely painful. Production is throttled at both ends of the plant under such conditions.

Heavy shipments of sockets and other devices have been made to New England jobbers by local factories, following the imposition of strict embargoes on shipments through New York City and the gateways leading to Western points. These jobbers built up stocks rapidly in the weeks following the outbreak of the switchmen's strike, and such deficiencies as existed in territory within relatively easy reach of the factories were soon overcome. Within the last few days the flow of schedule material into Boston, New York and other centers adjacent to the manufacturing plants has lessened considerably, although there has not been any general tendency by jobbers to cancel orders. Instead, instructions have been sent to the factories temporarily to suspend shipments to particular jobbers whose stocks have been heavily enlarged. The difficulties of obtaining raw materials by rail, combined with iron-clad embargoes on outward shipments, led a leading manufacturer in Connecticut to close his factory for a week. Production there was resumed on Thursday of last week, and carload shipments are reported to have been resumed to Chicago, although on a subnormal scale.

One Middle Western representative of an Eastern factory did not receive a pound of schedule material for a month, and even boat shipments have been delayed and upset by labor troubles along shore. It is doubtful if manufacturers in this line are receiving more than 40 per cent of the material at the outside needed for full production, but the primary cause appears to be transportation inadequacy and not acute shortage of materials in themselves. Brass and copper have been in good supply notwithstanding strikes in the Naugatuck Valley. Porcelain and other insulation, while far from plentiful, has been obtainable in many instances by motor-truck service. Manufacturers who have forecast their raw material needs and ordered well ahead from regular sources are much better off than those who buy from hand to mouth.

Prices are steady in this branch of the industry. The volume of trade is much larger than was the case last year at this time, and in one representative plant the equivalent of 47 per cent of the entire business of 1919 was produced in the first quarter of this year. In April, however, only 40 per cent of the March output was shipped, owing to the transportation situation. Foreign business is extremely active in plants catering to that class of trade, April showing the best figures in the history of one important manufacturer. Deliveries of schedule material are now quoted on a three to four months' basis. There are no comprehensive factory stocks, although stocks of finished goods due for shipment will burden floor space for some time, pending material improvement in transportation conditions. Some extensions of plant are to be made at once, including the provision for increased storage facilities. The demand for these products bids fair to run into heavy totals for a long time to come, and if the transportation problem can be even partially solved, in comparison with recent stringencies, schedule material manufacturers will be able to serve the electrical industry better than at present seems possible. One more schedule material manufacturer, the Hart Manufacturing Company, has eliminated plus discounts by doubling lists and changing discounts to leave the same net. This change was effective April 1.

Greater Care Being Exercised in Credit Situation

WITH the general stifling of freight movement and the volume of orders overwhelming the manufacturers, credits are being watched extremely close. The wave of buying which has been sweeping the country has resulted in a severe taxing of the entire credit system. Raw and finished products are taking weeks and sometimes months to reach their destinations, and meanwhile the investment tied up in those shipments may have to be carried at a rate of 8 to 10 per cent. Warehouses are piled with finished goods, held up for lack of cars, and here too is the idle investment. Jobbers and distributers are being billed for goods shipped weeks ago which they have not received and on which they are getting no return.

All along the line it is costing more to do business and costing more to meet obligations than it did before the winter. Collections are lengthening. Where thirty to forty-day collections have been holding rather steadily, they are running up into the forty and fifty-day periods. Financial houses are scrutinizing very carefully the paper that is being offered them, and that of a speculative character is carrying relatively less weight than it did a short time ago.

Motor Stocks Almost Gone from Market

CONTRACTORS are having considerable difficulty in getting motors for their jobs. An extremely heavy call seems to be coming from the rather smaller shops, which are expanding their productive capacity and need a few motors. The larger manufacturers, too, are demanding motors in increasingly larger numbers, and it is almost impossible to keep up with the pace. Manufacturers' local stocks throughout the country are virtually depleted, and second-hand dealers and motor agents have only the barest semblance of a stock.

Freight tie-ups are permitting manufacturers who have raw materials to get a little bit ahead on their stocks, but little is moving away. Motor trucks are still taking a small percentage to the most essential jobs, but are hardly scratching the demand. This demand is running now to the sizes up through 10 hp., while two years ago it was around 20 hp. One prominent manufacturer states that outside of the fractional sizes 25 per cent of present demand is for 5-hp. motors.

Quoted shipments on these sizes up to 25 hp. are in the most favorable instances found to be around twelve weeks, and from there on up into the fall months. This embraces both polyphase alternating-current and direct-current motors. Starters are nearly as bad as the motors as far as shipments are concerned.

Production of Ferrous Wiring Materials Is Light

WIRING materials employing steel or iron in their make-up are virtually out of the market for the time being. It is true that here and there jobbers report receipt of a carload of pipe or flexible armored conductor, but it is found that this material comes from the general sorting out of freight cars in yards. These yards still contain many carloads of steel strip and pipe and fittings. Condulets and fittings of this type are in better supply as they are being substituted by contractors for elbows and other pipe fittings. The dearth of this steel and iron material is acute; jobs are being held up here and there for lack of it.

Virtually no flexible armored conductor is being produced, and supplies of its connectors and other fittings are exceedingly low. The small amount of steel strip that is being trucked is hardly a factor in the market. It is reported that, with steel mills working much below capacity, there is little sheet steel available for the electrical industry after supplying the demand of the automobile industry, which is willing to pay a premium to get it. From one source supply of sheets for industrial reflectors is shown to be extremely low, with little available before next fall. From another source there is sufficient in this manufacturer's stock for present needs.

Metal Market Situation

FREIGHT conditions are to a large extent responsible for a quiet copper market. Little interest is being taken in nearby shipments because consumers feel there would be no use in doing so with traffic virtually at a standstill. There was a little better interest displayed last week, however. Practically all the large consumers have covered their requirements through the second quarter, and just little fill-in lots are now going through.

Producers are asking 19 cents for nearby and June copper, and in a few instances they are going into July on that price. But future positions are attracting almost no attention. In some quarters it is felt that this period of freight stagnation will put off the period of future buying for a short time. The second market is making prices of from 18⅛ to 18¾ cents, and this market is receiving an increasing number of inquiries from electrical manufacturers and wire drawers. Refineries are shipping almost no copper, except where consumers will truck it away. They are short of raw materials and coal. Embargoes are keeping the New England market almost dry.

It is reported that the Copper Export Association is financing purchases of copper in America by French consumers. The demand from this source is off a bit because of labor disturbances in France.

The price of lead was lowered by the leading interest on May 7 to 8.50 cents, New York, a drop of ¾ cent. There is little spot in New York and May delivery is well sold. There is little interest in June and beyond, the price of June lead being about 8.10 cents.

NEW YORK METAL MARKET PRICES

	May 5	May 12
Copper	£ s d	£ s d
London, standard spot	101 5 0	101 5 0
	Cents per Pound	Cents per Pound
Prime Lake	19.00	19.00
Electrolytic	19.25	19.00
Casting	18.37½	18.37½
Wire base	23.00	22.50-23.00
Lead, trust price	9.25	8.50
Antimony	10.00	9.75
Nickel, ingot	43.00	43.00
Sheet zinc, f.o.b. smelter	12.50	12.50
Zinc, spot	8.20	8.10
Tin	58.00	56.50
Aluminum, 98 to 99 per cent	33.00	33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	16.50 to 16.75	16.50 to 16.75
Brass, heavy	10.25 to 10.50	10.00 to 10.25
Brass, light	9.00 to 9.50	8.75 to 9.00
Lead, heavy	7.25 to 7.50	7.00 to 7.25
Zinc, old scrap	5.00 to 5.25	5.00 to 5.25

THE WEEK
IN TRADE

SERIOUS shortages in electrical supplies are reported from all parts of the country. Business generally is good wherever supplies are to be found, but stocks are so badly broken in most localities that contractors are having difficulty in going ahead with any kind of a building program. Lack of transportation is largely responsible for the serious condition in which many jobbers now find themselves. In the East shortages of cement, brick, lime, etc., are holding up much building work. Labor troubles in the building trades in various centers, including Chicago and New York, a coastwise shipping strike and embargoes put on by the railroads all have been effective in slowing down building construction.

Business during the next six weeks, which ordinarily would be exceedingly heavy on account of spring building, promises to be a severe disappointment unless freight now held up is rapidly released.

NEW YORK

All jobbers are faced with serious shortages of electrical supplies. Some of the jobbers' stocks are so low that it is only with great difficulty that any business at all can be transacted. Business for those jobbers who have been able to maintain principal stocks has been good, but this has been the case only in a few instances.

Freight is dribbling in, and virtually all kinds of supplies have been received during the week, but not in sufficient quantity to be of much use. Some trucking has been resorted to, but the high rates charged are almost prohibitive. Most jobbers are refusing to pay prices asked.

Collections are slightly off. This is the direct result of failure to receive goods billed by jobbers. In a number of instances goods have been en route for six to seven weeks and contractors are holding jobbers' invoices waiting for the freight to be unscrambled.

Orders have fallen off and demand for new buildings is greatly reduced on account of scarcity of non-electrical building materials. Most of the work being done is on remodeling of old buildings.

Heating Appliances. — Manufacturers are expected to advance the prices of flatirons, toasters, etc., about May 15. The increase on irons will amount to about 6 per cent.

Flexible Armored Conductor.—Some stocks are arriving by truck, but the amounts are small. Some jobbers have advanced prices, although the majority are holding to $110 per 1,000 ft. for No. 14 double-strip in lots of 1,000 ft. or more.

Motors.—Stocks have vanished with small prospects of getting any motors for some months to come. There are some in the hands of used-material dealers, but even these are few and far between.

Lightning Arresters.—Heavy demands have reduced stocks to almost nothing, and although a few have been received the number has not been large enough to fill back orders.

Transformers.—Distribution transformer stocks, which have a quick turnover, are virtually out of the market. Usual demand with no new stock coming in has resulted in an acute shortage of all sizes.

Compensators.—There are no stocks of compensators anywhere. Not a single compensator is reported in the stock of any representative number of jobbers.

Wire.—Rubber-covered wire has been received during the week in sizes up to 400,000 circ.mil, with the exception of No. 14. One manufacturer has marked up weatherproof 1 cent a pound on account of cotton.

Push-Button Switches.—This line, which was advanced by four manufacturers several weeks ago, as announced in these columns, has been marked up since by another manufacturer. Former shipments received by boat have been stopped. Small shipments are received by truck, but in general deliveries are unsatisfactory.

CHICAGO

Chicago's long-continued period of slackness in the construction industry has reached a point where it has become the subject of comment in the daily papers. New construction is being undertaken at the rate of approximately $1,500,000 a week, against a ten-year average of more than $2,000,000 and an average for the spring seasons of the past ten years of $3,000,000. Taking into consideration the present high cost of construction, it is evident that the physical volume of building is this year only one-half normal.

Production and transportation difficulties have been such that manufacturers and jobbers are having great difficulty in supplying even this reduced demand. The claim is made that railroad service is 80 per cent normal; if true, most of the shortage must be given to the electrical trade, for shipments are almost impossible of movement. Jobbers report that not a pound of freight has been received from various important producing points for more than five weeks. All manner of plans are being tried for securing goods, vast quantities being shipped in solid cars to Hammond, Ind., or other nearby points and trucked on into the city. The expense on such work is figured at one dollar or more per truck-mile and is adding materially to the jobber's financial burden.

Local factories, through scant raw material and coal supplies, are showing lessened production. This combination of circumstances is delaying the day when back-order files will return to normal and dealers' and jobbers' stocks hold a reasonable amount of goods.

Collections are a little tight. Slow deliveries have thrown a heavy financial burden on the jobber, and general tightness in money has rendered his situation more difficult. Reports show collections ranging from forty-one to fifty-two days, with those interests which favor the use of trade acceptances making the better record.

Lamps.—Stocks here are in a deplorable condition, solely on account of transportation troubles. Receipts for the last six weeks have been negligible and stocks already low have evaporated. Emergency needs are being handled by trucking goods into Chicago from points outside the city where freight is stalled. Demand is normal except from railroads, which are placing unusually heavy orders.

Fans.—Local supply is low, only certain types being available, while new orders continue to be placed in large volume. Deliveries on goods from factory range from four to twelve weeks.

Wire.—As in all other lines, stocks are getting low, but as yet prompt deliveries are being made on most kinds from jobbers' stock. Minor fluctuations in the price of electrolytic copper are causing some price confusion. Several makers have advanced one cent to a 29-cent base, while others are still using 28-cent base. On a 28-cent base No. 8 weatherproof is 31 cents and No. 8 bare is $26.25 per 100 lb., in 200-lb. lots.

Line Tools.—Mathias Klein & Sons have withdrawn quotations on all wireman's tools. Pliers, splicers and similar items are almost wholly out of stock and delivery promises range around six months. Some climbers are available, in limited quantities only. Shovels, spoons and pike poles are in fair supply.

Insulators.—Supply conditions on porcelain insulators are getting constantly worse, owing to raw-material conditions. Deliveries are slow and uncertain and a threatened shutdown of some factories promises no immediate improvement. Trade conditions in glass remain more nearly normal.

Poles.—Producing fields are being seriously harassed by a timberman's strike. Open shop companies were not affected at first, but intimidation caused many of their men to quit. Poles, being sixth-class freight, are receiving scant consideration from the railroads.

Washing Machines.—Most makers remain able to make prompt deliveries, although Chicago factories are seriously troubled in securing coal and supplies. Local sales campaigns are meeting with marked success.

Heating Devices.—Hollow-ware remains hard to get, stocks still being seriously low. Delivery dates are uncertain and prices show an upward tendency. New lists are anticipated from various manufacturers in the immediate future.

BOSTON

Trade continues extremely active, the chief handicap being delivery conditions. These show a slight improvement and some carload freight is moving into New England for electrical purposes. Outward shipments are a trifle better. Collections hold up well. Stocks are somewhat larger in wiring material, but iron conduit is very hard to get. Prices are a little unsteady. Flexible armored conductor is quoted easier. Motors are in great demand, and a shortage of fans threatens this district this summer. Lamp cord is a little more plentiful in the cotton-covered type. Building operations scheduled to May 6 total $115,693,000 for New England, compared with $43,193,000 in the same period of last year. Since 1900 this annual total to May 6 has never exceeded $67,000,000. Street-lighting extensions are being prepared in various places, and industrial-plant additions continue to occupy attention. Labor is on strike in important textile centers, but a threatened walkout on a considerable scale at the Lynn Works of the General Electric Company has been averted. Brass mills in Waterbury are hard hit by strikes.

Wire.—Mills at Ansonia, Conn., have resumed work, following the return of employees forced out by an unsuccessful strike of unskilled laborers. Rubber-covered No. 14 wire is firm at $11 per 1,000 ft. in 25,000-ft. lots. Weatherproof and bare copper are quoted on 28-cent and 24-cent bases. Finer sizes of wire used in instrument coils are scarce.

Commutator Bars.—Recent strikes in the Naugatuck Valley have impeded the output and delivery of commutator bars. Conditions are expected to improve soon.

Electric Starters.—Transportation difficulties have cut production in one representative Massachusetts factory from 800 to 400 sets per day. Raw material and finished-product movement has been slow.

Lamps.—Current requirements are being well handled, but no excess stocks are being built up, so far as can be learned. Prices are steady. Motor-truck shipments have been of great help.

Motors.—While prices are steady, stocks are virtually shot to pieces as regards smaller-sized motors. Fractional-horsepower motors are almost unobtainable, and up to 25 hp. alternating-current motors are very low in supply. Carload shipments of motors are on the way to Boston, but these will be quickly absorbed by the market.

Flexible Armored Conductor.—This material is easier at $110 per 1,000 ft., in single-strip, No. 14. Stocks have been much improved of late, in spite of the active demand.

Non-metallic Flexible Conduit.—Loom is now sufficiently plentiful to permit sales of 5,000-ft. lots in a fairly free market. The $\frac{3}{32}$-in. size in this quantity sells for $33.50 per 1,000 ft., and the $\frac{5}{16}$-in. size for $36.50. Wiring contractors are much relieved at the improved situation.

Lamp Cord.—Good stocks of cotton-covered cord are reported in Boston. This can now be had in 5,000-ft. lots at $28 per 1,000 ft., in No. 18 size.

Schedule Material.—Local jobbers are getting well stocked, and instructions to slow up shipments have been sent in some cases to the factories. Transportation difficulties caused the shutdown of a large Connecticut factory for a week, but conditions are slowly improving and it is believed that vigorous efforts to get in raw material will enable such plants to keep going henceforth. Socket prices show no change from last week.

ATLANTA

Despite unfavorable weather conditions, there has been no decrease in building or other commercial and industrial activities, although continued rains have so retarded spring planting as to cause a feeling of pessimism in the rural districts. This, however, has not yet been reflected in business conditions, and proposed construction both in the country and city districts is being announced daily. The threatened walkout of union labor in Atlanta failed to materialize and the prospects at present are that no concerted action will be taken. The striking tinners, painters and glaziers have been replaced; the plumbers' strike has failed to interfere materially with building operations.

Jobbers report that the embargoes on shipments from the East and Middle West are being acutely felt. Badly needed material held for shipment in the East cannot be started for lack of cars, and local stocks are showing the effect of this failure to receive shipments.

Bank collections continue to show a gain of 30 per cent to 45 per cent over the same period of last year, and collections in general are reported good.

Wire.—A slight advance is to be noted in the way of smaller discounts, but no change has been made in the base, which is quoted at 28 cents rubber-covered, 29 cents weatherproof. Rubber-covered stocks, with the exception of No. 12, are in fair condition, but one of the largest jobbers reports no weatherproof on hand. Shipments are quoted at from eight to ten weeks, and orders for No. 12 rubber-covered now three months old have not been filled.

Distribution Transformers.—These are being received slowly and local stocks are in bad shape. The popular sizes of 5, 10, 15 and 25 kva. are not available for immediate service and shipments are quoted at from three to four weeks. Much difficulty is experienced in serving new customers promptly because of this condition.

Non-metallic Flexible Conduit.—A slight betterment in this line is reported this week, one jobber having received a shipment of 25,000 ft. and promise of 50,000 ft. additional in the next ten days. The first shipment was absorbed by back orders, while the second shipment will fill only one-half of the orders on hand. Prices, lots of 250 ft. to 1,000 ft., $\frac{1}{16}$-in., $5.52 per 100 ft.; $\frac{3}{32}$-in., $5.06 per 100 ft.

Schedule Material.—No improvement in stocks is to be noted. Acute shortage exists in those articles requiring porcelain, also in knobs, cleats and rosettes. Good stocks of pull-chain sockets and fair stocks of key sockets are reported on hand.

Friction Tape.—A sufficient quantity is on hand to supply the present demand, although an increase of approximately 20 per cent in price has been made. Shipments are reported fair in the face of brisk demand.

Poles.—Difficulty is being experienced in obtaining shipment on any class of poles, owing to car shortage, and construction work is being badly delayed because of this fact. Manufacturers report stocks on hand sufficient for the demand but cannot obtain cars. Prices, 30 ft., 7-in. tops, Western red cedar, $12.80; white cedar, $7.50.

Safety Switches.—Local building activities have depleted stocks of this specialty, even in the face of fair deliveries. Prices are quoted as follows: Standard packages, two-pole, 30-amp., $1.76; three-pole, 30-amp., $2.64. Broken packages, two-pole, 30-amp., $2.04; three-pole, 30-amp., $3.06.

Flashlights.—Demand continues to hold up excellently and stocks have become rather spotty with shipments reported only fair. There are, however, sufficient supplies of batteries in the territory.

SEATTLE—PORTLAND

In spite of chaotic deliveries, shortage in stocks and fluctuating prices, there is no apparent decrease in the trade volumes in the Pacific Northwest from week to week. This condition is especially noticeable in Seattle, Tacoma and other Puget Sound cities where building is opening up on a scale in excess of the most optimistic expectations. Collections, generally speaking, are holding up well, those from out-of-town dealers being especially good for this time of the year. Weather conditions in this district during the past three weeks have been ideal from an agricultural standpoint. Lumber mills and logging camps are running full blast and the steel shipyards will resume work on recently awarded contracts as soon as steel from the East can be laid down. The labor situation in the Puget Sound country is easy, with plenty of common labor to be had. Business in general seems to remain relatively quiet. Credit is tightening, jobbers are watching particularly new organizations which have started during the last year or so and which have not yet become well established. Collections are noticeably poorer than they were. There is a great difference of opinion existing at the present time as to whether all these indications point toward the fact that the crest of the wave of high prices has been reached. There is an indication, however, that some badly needed improvements that have been delayed for a number of years in railroad circles are to be taken care of gradually. The labor situation is rather peculiar. Common laborers seem to be very difficult to secure. However, reports are that a large number of journeymen wiremen are available with no work to do.

Line Tools.—In the face of an increasingly active demand of recent date, stocks are in poor condition, especially along the line of smaller tools. Indications, however, are that the situation locally will be improved within the next two or three months. There is considerable line work progressing, the major portion being replacements and betterments to existing lines in rural districts.

Appliances.—Steady demand along practically every line is being inadequately met by insufficient and depleted stocks. Jobbers have practically abandoned hope of normal stocks or even sufficient stocks to meet demand for a year at earliest. Shipments from factories are poor and erratic.

Glassware.—Existing shortage in this section is becoming more acute owing to the increasing demand. Little or no hope is held out for immediate improvement within six months.

Flexible Armored Conductor.—There are no stocks worth mentioning in this district, and shipments are snapped up on arrival; this in the face of good demand.

SAN FRANCISCO

Exceedingly important electrical conventions are now in full swing in California, the month of May being marked by the Del Monte and Pasadena meetings. Building construction has dropped off within the last few days, and dealers are now principally busy with the completion of existing contracts. Comparatively few new ones of any size have been signed. Device business, too, is rather quiet, although this is partly caused by the absolute exhaustion of available stocks on certain lines.

Ironing Machines.—There are now few electrical dealers who do not display ironing machines on their floors, and in many cases excellent demonstrations have been placed. Sales have been a little slow recently. Stocks are fairly good with the demand concentrated on the 42-in. width roll.

Heating Material.—Renewed effort by certain companies to stimulate heating business has resulted in many orders. Orders are now being taken for Christmas deliveries, and many dealers, remembering the wild scramble during the fall of 1919, are protecting themselves by ordering early and often. Coast stocks are poor.

Vacuum Cleaners.—Except in the case of big department stores, there has been a recent tendency among dealers to concentrate upon one or two makes which has gradually meant the elimination of the half dozen or more models that were being carried during the fall of last year. Customers were often embarrassed by this multiplicity of makes and gradually reached the condition where they would not buy at all unless they tried out several types. Dealers now are concentrating on fewer types and find that it does not hurt their sales and, besides, increases the rate of their turnover

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Portable Wireless Set

The usual outside aërial, says the producer, can be eliminated by the use of a portable wireless set manufactured by the Winn Radio & Electric Manufacturing Company, Chicago. It is claimed that this set can be operated successfully from a loop aërial inside a house for a sending range of from 10 miles to 12 miles and for a receiving range

COMPLETE WIRELESS SET WEIGHS 15 LB.

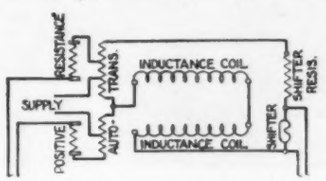
of from 200 miles to 300 miles under favorable conditions. In the newly designed detector used on this instrument a glass dust-proof cylinder keeps the crystal clean and free from vibration. The interrupter is equipped with heavy platinum iridium points. By the use of sliders for regulating the tuning coil every strand of wire in the coil can be utilized. The instrument is cased in an 8-in. x 9-in. x 11-in. mahogany finished box and weighs complete about 15 lb.

Electrode Cooling Ring for Electric Furnace

In order to prevent the ignition of the hot gases escaping from the furnace roof, the Electric Furnace Construction Company, Philadelphia, Pa., has designed a cooling ring for the electrode. The roof portholes are kept cool, the electrode is kept reasonably so, and the gases are cooled down as they leave the furnace, says the manufacturer. The gases, after passing through the roof porthole around the electrode, pass through a clearance in the cooling ring and into a relatively larger chamber. Here they expand and give up considerable heat, which is absorbed by the water in the cooling ring. This process is repeated in a larger chamber, and a thin inclosing cover dissipates still more heat as the gases pass out to atmosphere, too cool, says the manufacturer, to ignite. The cover is made adjustable to allow for different working conditions with different electrodes. The standard form of the electrode economizer will have the bottom flat, but in cases where the roof is arched they can be made to conform to the curvature of the roof.

High Power-Factor Mercury Vapor Lamp

To overcome objections to low power factor encountered in the operation of mercury-vapor lamps on alternating-current supply, the Cooper Hewitt Electric Company, 95 River Street, Hoboken, N. J., has developed and is marketing its EC auxiliary for use with type F lamps. The new feature of this auxiliary is a positive low-resistance unit which takes the place of the former choke coils, and through its use the manufacturers say that the power factor of the lamp has been raised to 85 per cent from the former value of 52 per cent. In addition, the weight of the EC auxiliary has been reduced to 42 lb. net, a saving of 14 lb. over the old E. A. auxiliary. There is also



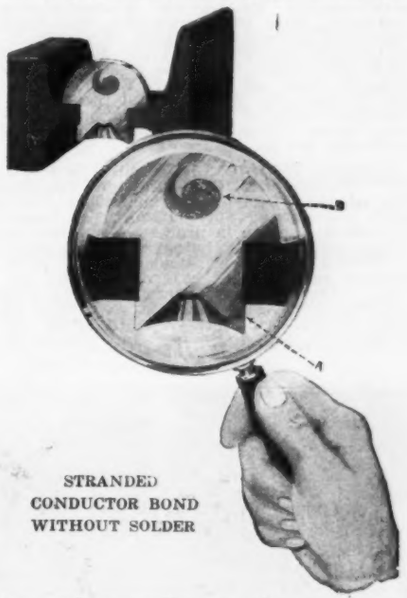
POWER FACTOR INCREASED TO 85 PER CENT

an increase in allowable voltage variation, the present regulation being 25 per cent, while formerly it was 12 per cent. Present wattage is 430 watts so that the candlepower of the tube is increased 12 per cent. The tube will operate at 3.8 amp. direct-current normal through the tube. The weight of the auto-transformer is slightly reduced because of less current flowing through it.

In the illustration the two leads at the left connect with the positive terminals of the tube, while those at the right connect with the negative terminal and the starting band of the tube. The lamp is adapted to alternating current circuits only and can be used only on its specified frequency and within its own voltage range.

Rail-Bond Terminal

A rail-bond terminal for use with stranded conductor has been developed by the American Mine Door Company, Canton, Ohio. The Canton bond is made of ductile metallic composition. The shank which goes through the rail supports a U-shaped head on broad shoulders. When the cable bond is inserted in the U-opening the ends of the U are pressed down over the cable, and



STRANDED CONDUCTOR BOND WITHOUT SOLDER

one end, according to the design, is pressed into the strands to improve contact at all points. Soldering is not necessary. When pressed into the rail a shoulder is formed on the second side of the bond.

Notes on Recent Appliances

Valve Grinder

A worm-drive electric value grinder for internal-combustion engines has been developed by the Consolidated Machine Tool Company, Worcester, Mass.

Floor Surfacer

A motor-driven floor surfacing machine has been brought out by the G. M. Watters Manufacturing Works, Minneapolis, Minn.

Connector Plug

A connector plug designed to fit all heating appliances interchangeably has just been developed and is now being marketed by the Magnus Electric Company, 109 Broad Street, New York City.

Mining Locomotive

Developments in its electric gathering locomotives for mine use have been made by the General Electric Company.

Multiple Christmas-Tree Outfit

For use on 110-120 volts, the Betts & Betts Corporation, New York City, has developed a mulitple Christmas-tree lighting outfit.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

G. E. STOLTZ, general engineer of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has been appointed engineer in charge of the steel-mill section of the engineering department. After graduation from the electrical engineering course of the Ohio State University in 1909, Mr. Stolz entered the apprenticeship course of the Westinghouse company, after which he became engaged in steel-mill work.

HALF A MILLION DOLLARS' WORTH OF TRANSFORMERS.—In the hoisting bay of the Pittsburgh Transformer Company more than $500,000 worth of transformers are shown in process of assembling In the center of the photograph is one bank of three 2,000-kva. self-cooled transformers without radiators or external cooling devices. The corrugated tank incasing this transformer is said to be large enough to take a 5,000-kva. unit. The tanks in the foreground are three of the company's

HOISTING BAY IN PITTSBURGH TRANSFORMER COMPANY PLANT

vacuum and impregnating tanks. This erecting bay is in the Juanita plant of the Pittsburgh Transformer Company, which is one of its three factories, each of which occupies approximately 300 ft. x 120 ft.

THE WOLKE LEAD BATTERIES COMPANY, Louisville, Ky., successor to the Peerless Storage Battery Company of Louisville, has changed the trade name of its battery from "Peerless Red Cap" to "Wol-Kee Red Cap." No change has been made in the personnel and management of the company.

WALTER N. POLAKOW & COMPANY, INC., industrial management and power production engineers, announce the new location of their offices at 33 West Forty-second Street, New York City.

THE DAYTON FAN & MOTOR COMPANY, Dayton, Ohio, announces that Ernest Boehme, Lee Warren James, Maurice D. Larkin and Louis Ruthenburg have acquired the controlling interest in its property and will assume active management at once.

W. N. MATTHEWS & BROTHER, INC., St. Louis, Mo., announces that the Chicago office is now at 29 South Desplaines Street, with Walter E. Bischoff in charge

L. BRANDENBURGER, Salt Lake City, Utah, formerly established in the Walker Bank Building, has taken over larger quarters at 59 West Broadway. Mr. Brandenburger was recently appointed sales representative for the Cutler-Hammer line of motor starting and control apparatus, magnetic clutches, brakes, lifting magnets, magnetic separator pulleys, etc., for the territory extending throughout the State of Utah, the western section of Wyoming and three-quarters of the State of Idaho.

JOHN C. DOLPH COMPANY, 168 Emmet Street, Newark, N. J., manufacturer of insulating varnishes and compounds, announces that the selling arrangement in effect with the Dolph Manufacturing Corporation has been discontinued and that sales will be handled direct from its factory.

L. W. HAIG has been appointed district sales manager of the Packard Electric Company at Buffalo, N. Y. After being graduated from Purdue University Mr. Haig became connected with several electrical concerns where he specialized on the design of transformers.

THE KELLOGG SWITCHBOARD & SUPPLY COMPANY, Chicago, has voted to increase its common stock from $4,000,000 to $8,000,000 and reduce the par value from $100 to $25, old stock to be exchanged in the ratio of four to one. Twenty thousand new shares will be sold to employees on terms to be fixed by directors.

THE PHILADELPHIA STORAGE BATTERY COMPANY has awarded contract for a two-story reinforced-concrete building, 40 ft. x 219 ft., to be erected on Ontario Street, west of C Street, to cost $142,600.

THE DELHI BATTERY & SUPPLY COMPANY, 2700 Locust Street, St. Louis, Mo., has completed plans for the construction of a two-story building, 80 ft. x 135 ft., to cost about $100,000.

THE LOCKE INSULATOR COMPANY, Victor, N. Y., has awarded contract for construction of its proposed plant at Baltimore, Md., to cost about $500,000.

THE NATIONAL ELECTRIC SUPPLY COMPANY, Washington, D. C., is planning improvements to its plant at 1328-30 New York Avenue, to cost about $100,000.

THE FEDERAL ELECTRIC COMPANY, Chicago, announces that it will move from its present quarters at Lake and Desplaines Streets to a new plant which it has erected at Eighty-seventh and State Streets. The company was incorporated in 1901 for the purpose of manufacturing and selling signs. It early realized that it could fill an urgent demand by renting signs. In 1905 the Federal Sign System (Electric) was incorporated for the purpose of carrying on the sign-renting business. Its principal function was to sell and rent signs made by the Federal Electric Company. The manufacturing of the vacuum cleaner was started in 1906, and in 1912 the first Federal washing machine was put on the market. The controlling interest of the Chicago Miniature Lamps Works was purchased in 1912. The growth of the Federal Electric Company is indicated by its sales. Eight years ago its annual washing-machine production was 1,000; today it is 24,000, and the sales are increasing so rapidly that only by the most strenuous efforts can production approach the sales. Eighteen years ago the company's annual sale of signs was $25,000; at the present time it is $1,000,000 and there are several hundred salesmen in the field. The vacuum-cleaner manufacturing department cannot keep abreast with the demand. Twenty-five thousand vacuum cleaners are produced annually and they are all sold within a radius of 50 miles from the plant. Eight commodities are sold, but each of the eight is sold by separate sales divsions headed by an assistant to the sales manager. Each division has the co-operation of the other divisions.

IRA CUSHING has resigned from the Boston office of the General Electric Company to become sales engineer with James C. Barr, dealer in power plant, railroad and electric railway supplies, with headquarters at 84 State Street, Boston. Mr. Cushing is past chairman and secretary of the Boston Section A. I. E. E., and is widely known in New England electrical circles. For some years he has been engaged in switchboard engineering and other special work in the Boston office of the General Electric Company.

HARRY M. GARDINER, who for ten years has been connected in an engineering capacity with various subsidiaries of the General Motors Corporation, has become manager of the Detroit office of the Industrial Controller Company, with headquarters at 708 Ford Building. During his experience in the engineering field Mr. Gardiner was from 1906 to 1908 assistant engineer of the Delray power station of the Detroit Edison Company; from 1908 to 1910 he was electrical engineer for the Navy Yard at Charleston, S. C., and from 1910 to 1916 he was electrical engineer for the Northway Motor & Manufacturing Company of Detroit; from 1916 to 1918 he was superintendent of power for the Cadillac Motor Car Company of Detroit; from 1918 to 1919 he was consulting electrical engineer for the General Motors Corporation at Detroit, and from 1919 to March 31, 1920, he was works engineer for the Olds Motor Works at Lansing, Mich.

CHARLES H. LEPPERT announces that after April 1 he will be at 550 Asylum St., Hartford, Conn.

THE CHICAGO FUSE MANUFACTURING COMPANY has removed its office and factory to Laflin and Fifteenth Streets, Chicago, where it will have larger quarters.

THE STATE ELECTRIC COMPANY, Canton, Ohio, contractors, has increased its capital stock from $50,000 to $250,000 for expansion purposes. The company also plans to handle suction sweepers and other electrical equipment for use in office buildings and shops.

THE PROMETHEUS ELECTRIC COMPANY, 571 West Forty-second Street, New York, manufacturer of heating apparatus, has increased its capital stock from $500,000 to $850,000.

THE ROME (N. Y.) WIRE COMPANY has taken over the plant and holdings of the Electric Rod Mill of Rome.

THE WOODFORD ELECTRIC COMPANY, 118 North La Salle Street, Chicago, Ill., contemplates the erection of a two-story building, 44 ft. x 120 ft., to cost about $125,000.

THE A. F. McCARTHY COMPANY, 10 High Street, Boston, Mass., will act as representative for several manufacturers of electrical materials and specialties in New England, including Edward & Company, Inc., New York, N. Y.; King Manufacturing Company, St. Joseph, Mo.; Beers Sales Company, New York, N. Y.; Dongan Electrical Manufacturing Company, Detroit, Mich.; Arts Electrical Company, Troy, N. Y., and the Ajax Electric Specialty Company, St. Louis, Mo. Mr. McCarthy has served in the electrical field continuously since 1900, when he entered the employ of the New York Edison Company. During the past twelve years he has represented the Westinghouse Electric & Manufacturing Company and several electrical supply jobbers in New England territory.

THE TURNBULL ELECTRIC MANUFACTURING COMPANY, Brooklyn, N. Y., recently incorporated to manufacture renewed lamps and to deal in all makes of lamps, has taken possession of its plant at 1237 Atlantic Avenue.

Supply Jobbers' Notes

THE GEORGE F. GRANT COMPANY, formerly at Binghamton, N. Y., has moved its office and warehouse to 140 West Thirty-fourth Street, New York City, where it will continue its business of jobbing electrical appliances and supplies.

THE CLEVELAND ELECTRICAL SUPPLY COMPANY, recently incorporated with a capital stock of $200,000 as successor to the Guttentag Light Company, at 504 Prospect Avenue, Cleveland, Ohio, will occupy a new four-story and basement building at 220-222 High Street, Cleveland. The new company will conduct a wholesale electrical jobbing business, having given up its retail store, and will cover Ohio and northern Pennsylvania.

THE PERRY-MANN ELECTRIC COMPANY, INC., Columbia, S. C., announces the election of W. L. Perry as secretary and treasurer, to succeed M. L. Mann, whose resignation became effective May 1. The Perry-Mann Electric Company will continue to improve its service to customers and aims to conduct its business in accordance with the strictest interpretation of the principles embodied in the Goodwin plan. The company will continue to handle its present line of electrical products.

Foreign Trade Notes

THE ATLAS MANUFACTURING COMPANY, 234 Cameron Street, Port Arthur, Ont., is negotiating for a building on Ambrose Street, which will be rebuilt and the ground floor used for manufacturing purposes. The company will manufacture electrical apparatus, including table lamps, electric call systems, etc.

THE CANADIAN WESTINGHOUSE COMPANY, Hamilton, Ont., Can., is planning an addition to its local plant, to cost about $25,000.

THE POWER SPECIALTY COMPANY 111 Broadway, New York, manufacturer of coolers, heaters, superheaters, etc., is erecting a factory at St. Catharines, Ont., Can. A foundry will be built later.

RAILWAY ELECTRIFICATION IN BRAZIL.—Since the announcement of the Paulista railway electrification in Brazil was made in the April 24 issue of the ELECTRICAL WORLD, it has been learned that the Westinghouse Electric International Company has obtained contracts for a portion of the equipment therefor. Two of the four locomotives to be built by this company are for passenger service and two are for freight service. The passenger locomotives have a one-hour rating of 2,000 hp. and weigh 121 tons. They will be operated from a 3,000-volt direct-current overhead-trolley system and will be complete with regenerative control. They are designed for a maximum speed of 65 miles per hour and have a track gage of 5 ft. 3 in. The freight locomotives have a one-hour rating of 1,500 hp. and will weigh 87 tons. They are operated from the same voltage and have regenerative control. The speed is 40 miles per hour.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A merchant in Switzerland (No. 32,666) desires to secure the general agency for the sale of electric cooking and heating stoves.

A merchant in Palestine (No. 32,676) desires to secure an agency for the sale of electrical goods, etc.

A firm of general representatives of American exporters in Mexico (No. 32,694) desires to secure agencies for the sale of incandescent lamps.

A company in Switzerland (No. 32,715) desires to get in touch with firms exporting 120-volt electric incubators complete with all necessary accessories.

A commercial agent in Italy (No. 32,681) desires to secure an agency for the sale of electrical machinery in general, including small and medium-size three-phase motors, electrically driven pumping machinery for water, etc.

An electric power company in Japan (No. 32,686) desires to purchase in very large quantities galvanized-iron wire of all sizes and measuring instruments, meters, etc., for use in electrical work.

A mining corporation in South Africa (No. 32,689) desires to purchase electrical furnaces for heat-treating drill steel, the furnace to be made of highly refractory material.

Electrical & Engineering Development, Ltd., 82 Victoria Street, London, S. W., 1, England, advises that it has been formed specifically to develop export trade to Europe, for the acquisition of the American patent rights on European electrical inventions and for the sale or disposition of European patent rights on American inventions. It has appointed engineers and representatives in the principal industrial countries and has laboratories equipped for testing and developing inventions.

Trade Publications

GENERATING SETS FOR MARINE USE.—A booklet issued by the Delco-Light Company, Dayton, Ohio, describes and illustrates the Delco-Light electric generating sets for commercial and pleasure craft.

RADIO APPARATUS.—The Wireless Improvement Company, 47 West Street, New York, N. Y., has issued a folder covering its radio apparatus, including marine, field and airplane types.

ELECTRIC RIVET HEATER.—The American Car & Foundry Company, 165 Broadway, New York, N. Y., has issued a booklet describing the Berwick electric rivet heater.

MARINE CONTROL APPARATUS.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has issued a booklet describing and illustrating the use of electrical marine apparatus.

CENTRIFUGAL CLARIFICATION.—The De Laval Separator Company, 165 Broadway, New York, N. Y., has recently issued bulletin No. 200, describing the De Laval method of centrifugal clarification of varnishes, japans and pigment goods.

COOKING BY ELECTRICITY.—The Estate Stove Company, Hamilton, Ohio, has issued a booklet entitled "Cooking by Time and Temperature," describing and illustrating its electric cooking stoves.

WIRES, CABLES AND CORDAGE.—The Belden Manufacturing Company, Chicago, Ill., is distributing catalog No. 8, giving prices and other data on electrical wire, cordage, cable, insulating materials, winding machines and other products manufactured by the company.

MAGNETIC CHUCKS.—The Heald Machine Company, Worcester, Mass., has issued bulletin No. 20-22A, describing the Heald grinding machines and magnetic chucks, and a booklet entitled "Heald Machines in Operation."

STEEL POLES—The Bates Expanded Steel Truss Company, Chicago, has just published a 128-page 1921 edition of its steel-pole treatise.

ELECTRIC MOTOR CONTROL.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued circular 1608, in which it describes and illustrates the control of electric motors in industrial applications.

OUTDOOR SUBSTATIONS.—The Delta-Star Electric Company, Chicago, Ill., is issuing a special publication No. 92, describing a few forms of its unit-type high-tension outdoor substations.

WIRE—The Page Steel & Wire Company has just published a pamphlet describing the electrical and physical properties of American ingot iron ware.

PYROMETER—Apparatus for automatic temperature control in steel-hardening furnaces, drawing furnaces, japanning and enameling ovens, glass-annealing ovens, etc., is described in bulletin 857, recently issued by the Leeds & Northrup Company, of Philadelphia, Pa.

New Incorporations

THE P. M. LAMP COMPANY, New York, N. Y., has been incorporated with a capital stock of $10,000 by I. M. Prokofirff, M. L. Rippe and J. Michael, 155 Gerard Street, Brooklyn, N. Y., to manufacture incandescent lamps.

THE MYLEY ELECTRICAL SUPPLY COMPANY, Brooklyn, N. Y., has been chartered with a capital stock of $10,000 by M. Schier, N. Cohan and M. Levy, 54 Lenox Avenue.

THE C. C. COGHLIN ELECTRIC COMPANY, Worcester, Mass., has been incorporated with a capital stock of $50,000 to deal in electrical supplies and to do a general electrical contracting business. The incorporators are: Charles C. Coghlin, Edith Coghlin and James C. Donnelly.

THE WOMELSDORF, MYERSTOWN & LITITZ TRANSIT COMPANY has filed articles of incorporation under the laws of Delaware with a capital stock of $1,700,000. The incorporators are: M. L. Horty, M. C. Kelly and S. L. Mackey, Wilmington, Del.

THE AEMILE BACHELET CORPORATION, Kingston, N. Y., has been incorporated by E. Bachelet, R. E. Smith and C. R. Cummings of Kingston. The company is capitalized at $150,000 and proposes to manufacture power generators, etc.

THE A. & M. RAINAUD COMPANY of Newark, N. J., has been incorporated by A. J. Rainaud, W. J. Rainaud and M. Rainaud of Newark, N. J. The company is capitalized at $125,000 and proposes to deal in lighting devices.

THE SERVICE ELECTRIC MANUFACTURING & SUPPLY COMPANY of Boston, Mass., has been incorporated with a capital stock of $50,000 to manufacture electrical supplies. The incorporators are John J. Donovan, James E. Cussen of Boston, and Thomas J. Carney of Medford, Mass.

THE CONTINENTAL RADIO & ELECTRIC CORPORATION of New York, N. Y., has been incorporated by G. E. Burghard, J. F. Grinan and F. di Blasi, 6 Warren Street. The company is capitalized at $30,000 and proposes to manufacture electric apparatus for wireless operations, etc.

THE GENERAL AUTO ELECTRIC COMPANY, 257 Halsey Street, Newark, N. J., has been incorporated by William F. Hencke, Daniel E. Lenthe and Frederick E. Draiss. The company is capitalized at $50,000 and proposes to manufacture electric specialties.

THE EVANS STORAGE BATTERY COMPANY, Camden, N. J., has been incorporated with a capital stock of $250,000 to manufacture storage batteries. The incorporators are Frank S. Muzzey, Joseph P. Murray and F. Stanley Saurman.

BOWERS & BARTLETT, INC., Riverdale, Md., has been incorporated by Claude C. Bowen, Harry O. Barlett and Charles C. Eckloff. The company is capitalized at $200,000 and proposes to manufacture washing-machine equipment and ironers.

THE VICTORY STORAGE BATTERY COMPANY, Maryland Casualty Building, Baltimore, Md., has been incorporated by A. J. Thompson, Edward B. Masterson and Henry Stockbridge. The company is capitalized at $319,000 and proposes to manufacture batteries.

New England States

MANCHESTER, N. H.—Extensive additions to the street-lighting system are being planned.

BOSTON, MASS.—Graphic Arts Printing Corporation, 516 Atlantic Avenue, plans to build a ten-story office building, to cost about $3,000,000. Lockwood Greene Company, State Street, are engineers.

CHESTER, MASS.—At a recent fire district meeting it was voted that the town assume control of the plant of the Chester Electric Light Company.

CLINTON, MASS.—The hydro-electric power plant of the Metropolitan Water Works at the Wachusett Dam has been damaged to the extent of $12,000, caused by the bursting of a turbine.

PITTSFIELD, MASS.—The Pittsfield Electric Company has been granted permission by the Public Utilities Board to issue $125,000 additional capital stock for additions to its plant.

HARTFORD, CONN.—Bids will soon be received for the construction of an addition to the Brown school on Talcott Street, to cost about $600,000. I. A. Allen, Jr., Inc., 904 Main Street, is architect.

NEW HAVEN, CONN.—Bids will be received by James P. Manning, superintendent of Charities and Correction, Room 2, City Hall, until May 18, for wiring the Springside Home and Farm and installing electrical equipment. Specifications may be obtained at the office of the Building Inspector, Room 3, City Hall.

NEW HAVEN, CONN.—The United Illuminating Company, 84 Temple Street, has awarded contract to C. W. Murdock, Inc., 185 Church Street, for construction of turbine room and to Westcott & Mapes, Inc., 207 Orange Street, for boiler room. Cost is estimated at $65,000.

Middle Atlantic States

ALBANY, N. Y.—The State Hospital Commission has awarded contract to the General Electric Engineering Company, New York, N. Y., for the installation of a fire-alarm system in the Central Islip Hospital, to cost $12,150.

BROOKLYN, N. Y.—The Commissioner of Public Works, Borough Hall, is having plans prepared by McKenzie, Voorhees & Gmelin, 1123 Broadway, New York City, engineers, for the construction of a municipal building, to cost about $5,000,000.

BROOKLYN, N. Y.—The Brooklyn Edison Company is having preliminary plans prepared for the erection of a substation on Grand Street, to cost about $100,000. William Whitehill, 55 Duane Street, New York, N. Y., is engineer.

BUFFALO, N. Y.—John Dunlop's Sons, 22 Fay Street, plans to erect a transformer station to cost about $5,000.

COHOES, N. Y.—Bonds to the amount of $45,000 have been authorized for electrifying and making other improvements to the local waterworks.

GLENS FALLS, N. Y.—The Adirondack Electric Power Corporation has applied to the Public Service Commission for permission to purchase the properties of the Glens Falls Gas & Electric Light Company, the Consolidated Light & Power Company and the United Gas, Electric Light & Fuel Company, with the view of increasing and extending its service.

MILLBROOK, N. Y.—Public Service Commission has granted the Hudson Gas & Electric Company a franchise to operate in Millbrook and the town of Washington. The installation of a new electric street-lighting system in Millbrook is contemplated.

NEW YORK, N. Y.—Contract has been awarded by the New York Telephone Company, to John I. Downey, 410 West Thirty-fourth Street, for the construction of a telephone exchange on Thirtieth Street and Second Avenue, to cost about $1,000,000.

NEW YORK, N. Y.—Contract has been awarded to the Turner Construction Company, 244 Madison Avenue, by the Western Electric Company, for the construction of a factory and warehouse, to cost about $2,700,000. McKenzie, Voorhees & Gmelin, 1123 Broadway, are engineers.

ALLENTOWN, N. J.—Bids will be received by the Borough Council, Borough Hall, Allentown, N. J., until May 24, for additions to the borough power plant as follows: producer, gas engine, generator, switchboard, piping, etc. Specifications may be seen at the above address.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

TONAWANDA, N. Y.—The Tonawanda Power Company plans additions to its plant equipment, to cost about $150,000.

BAYONNE, N. J.—The installation of a street-lighting system, "white way" type, on Broadway north from Twenty-sixth Street, is contemplated. The Uptown Improvement Association, 718 Broadway, is interested.

BAYONNE, N. J.—The International Nickel Company is planning to rebuild its steam plant with the purpose of increasing efficiency.

HOBOKEN, N. J.—The White Metal Manufacturing Company is contemplating the construction of a power house, to cost about $60,000. J. C. Schaeffer, 40 West Thirty-second St., New York, N. Y., is engineer.

JERSEY CITY, N. J.—The Central Railroad of New Jersey, 143 Liberty Street, New York, N. Y., is planning the construction of a 4,000-kw. electric power plant in connection with the new Greenville district terminal now under construction. Considerable electric equipment, including a 30-ton electric-operated gantry crane, will be required.

NEWARK, N. J.—The Foster Engineering Company plans to install an additional 100-hp. boiler and a 60-kw. generator.

NEWARK, N. J.—The Public Service Corporation, Terminal Building, contemplates the erection of a power plant, to have an ultimate capacity of 200,000 kva. The project calls for an expenditure of about $15,000,000.

BEAVER FALLS, PA.—Extensions to the street-lighting system is under consideration. The service is furnished by the Beaver County Light Company.

ELVERSON, PA.—Extension of the electric light and power system to Summit Level is under consideration.

LATROBE, PA.—Work will soon be started on the construction of a power plant at the St. Vincent's Arch Abbey, to supply light and power service to its entire group of buildings.

PHILADELPHIA, PA.—Plans have been prepared by the Rockford Knitting Company, Randolph and Jefferson Sts., for improvements to its factory power plant.

PITTSBURGH, PA.—Bids will be received by George W. Gerwig, secretary, 725 Fulton Building, until May 20, for installation of electrical equipment in the Duquesne, Bellefield, Crescent, Harwood, Jefferson, Minersville, O'Hara, Schiller and Springfield schools.

BALTIMORE, MD.—The Bailey Building Company has awarded contract to Norton, Bird & Whitman, 616 Munsey Building, for the construction of an office building, to cost $2,500,000. Ten electric elevators will be installed.

BALTIMORE, MD.—Plans are being prepared by Lockwood, Greene & Company, 101 Park Avenue, New York, N. Y., architects, for the construction of a shirt factory, to cost about $500,000. Considerable electric equipment will be required.

BALTIMORE, MD.—The Consolidated Gas, Electric Light & Power Company has prepared plans for the construction of a building at Kleman St. and the Western Maryland Railroad, to cost about $46,000.

CATONSVILLE, MD.—Plans are being prepared by C. L. Reeder, Park Avenue and Sartoga Street, Baltimore, for the installation of an electric generator, switchboards, etc., to cost about $100,000, in the Spring Grove State Hospital.

HAGERSTOWN, MD.—Bonds to the amount of $300,000 have been voted for the construction of a new municipal electric plant. A. B. Grubmyer, 21 East Franklin Street, is engineer.

SOUTH CHARLESTON, W. VA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 19, for electrical equipment for main substation, furnishing and installing switchboards, oil switches and barriers, buses and connections, storage-battery motor-generator set, transformers, disconnecting motor starters and other electrical equipment furnished by the government, and for making the necessary connections for a complete indoor substation ready for operation at the naval ordnance plant. Drawings and specifications may be obtained on application at the Bureau of Yards and Docks or inspector of ordnance in charge of plant named. Cost is estimated at about $195,000.

WASHINGTON, D. C.—Bids will soon be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the following: Kuahua, T. H., Schedule 4185—high-pressure air line. Loiza, P. R., Schedule 4194—radio building, towers and service connections.

WASHINGTON, D. C.—G. H. Rettew, 2357 Rhode Island Avenue, N. E., is in the market for three 75-kva. or three 100-kva., 25-cycle, single-phase transformers, outside type, 6,600/460 volts.

North Central States

BATTLE CREEK, MICH.—Plans are under way for the installation of an ornamental street-lighting system on Lake Avenue.

DETROIT, MICH.—Bids will be received by Louis Scisorek and A. Malkin, 225 Farwell Building, architects, for the construction of a battery service station for the Clements Battery Service Company, to cost about $35,000.

DETROIT, MICH.—Contract has been awarded to Joseph F. Dayton, 979 McKinley Avenue, by the Scheiwe Coal & Coke Company, 630 Mack Avenue, for the erection of a coal storage and conveyor buildings, 200 ft. x 200 ft. Motors will be installed to operate conveyors.

DETROIT, MICH.—The Board of Fire Commissioners has awarded contract to the Bryant & Detwiler Company, Dime Bank Building, for the erection of a central fire-alarm station at Macomb and Antoine Streets, at a cost of $162,937, and is in the market for automatic equipment for alarm system.

IRONWOOD, MICH.—Bids will soon be received by Alvord & Burdick, 8 South Dearborn Street, Chicago, Ill., engineers, for extensions to the waterworks system and installation of electrical pumping equipment, to cost about $300,000.

MARYSVILLE, MICH.—Plans are being prepared for the proposed waterworks system, including a pumping station and filtration plant, to cost about $200,000. The equipment consists of electrically driven centrifugal units. Robert Gordon is engineer.

MOUNT CLEMENS, MICH.—Contract has been awarded by the S. S. Kresge Company, Kresge Building, to George A. Fuller Company, 540 Penobscot Building, Detroit, for the construction of a pottery plant, 120 ft. x 823 ft. Electrical equipment, to include miscellaneous power motors, will be required.

AKRON, OHIO.—An ordinance providing for the erection of a municipal electric power plant has been introduced by Councilman Kasch for approval.

CLEVELAND, OHIO.—The Electric Vacuum Cleaner Company, Ivanhoe Road, East Cleveland, contemplates the erection of a larger shop and the installation of a direct-motor drive.

COLUMBUS, OHIO.—The Public Utilities Commission has authorized the Cleveland Electric Illuminating Company to issue $1,150,000 in bonds for improvements.

EAST PALESTINE, OHIO.—The City Council has authorized the employment of engineers to make a survey of the power situation, anticipating the grant of a franchise.

LINWORTH, OHIO.—Linworth Mutual Light & Power Company plans to erect a high-tension transmission line to Worthington and Dublin, at an estimated cost of $8,000.

TOLEDO, OHIO.—The erection of a substation at the Terminal Railway is contemplated by the Toledo Railways & Light Company, to cost about $225,000. The station will have a capacity of 10,000 kw. with space for future additions.

NORWALK, OHIO.—The City Council is considering the installation of an additional 1,000-kw. turbine in the municipal power station.

YOUNGSTOWN, OHIO.—The First National Bank is having plans prepared by Walker & Weeks, 1900 Euclid Avenue, Cleveland, architects, for the construction of a bank and office building, to cost about $2,000,000. Considerable electrical equipment will be required.

NEWPORT, KY.—The St. Joseph Orphanage plans to construct a reservoir to be equipped with electrically driven centrifugal pumps, at a cost of $20,000. George Horning, 512 Fairfield Avenue, Bellevue, Ky., is engineer.

PADUCAH, KY.—The Paducah Electric Company contemplates extensive improvements to its plant at Second and Monroe Streets. The company recently purchased a new city franchise.

BARGERSVILLE, IND.—Bids, it is understood, will soon be asked for the construction of a transmission line from Bargersville to Whiteland.

BATESVILLE, IND.—The Batesville Telephone Company has been purchased by John K. Johnson for $75,000. Additional equipment will be installed.

CHICAGO, ILL.—The Columbian Colortype Company has awarded contract to R. C. Wiekoldt, 1534 Van Buren Street, for the erection of a printing plant to cost about $650,000. The plant will be equipped for electrical operation.

LINCOLN, ILL.—The Lincoln Water & Light Company plans to expend $60,000 for improvements, to include the installation of a General Electric turbo-generator, also an addition of a switchboard and boiler, not yet contracted for.

PEORIA, ILL.—The installation of an ornamental street-lighting system on Madison Avenue is under consideration by the City Council.

SPRINGFIELD, ILL.—Contract has been awarded for the new power plant to be installed in the St. Nicholas Hotel, Washington and Jefferson Sts., to cost about $25,000. The equipment will include two 250-hp. Springfield boilers, two Illinois automatic stokers made in Alton, etc.

DES MOINES, IOWA.—The Des Moines Electric Company is contemplating the installation of new equipment, to cost about $1,000,000. The company has recently contracted for a 10,000-kw. turbine.

LETTS, IOWA.—The local electric plant is reported to have been destroyed by fire. A new plant will be erected.

MASON CITY, IOWA.—Miller Hotel Company is having plans prepared by Proudfoot, Bird & Rawson, 810 Hubbell Building, Des Moines, Iowa, architects, for the construction of a hotel to cost about $800,000.

ROCKHAM, IOWA.—The installation of an electric power plant is under consideration by the City Council.

CARTHAGE, MO.—At an election held April 8 the proposal to issue $100,000 in bonds for improvements to the municipal electric light plants and waterworks system was defeated.

ST. LOUIS, MO.—Improvements to the pumping station at the city sanitarium call for one 220-hp., horizontal, single-side crank engine, direct-connected to a 200-kw. generator now in place.

ST. LOUIS, MO.—The Joseph Greenspon Sons Iron & Steel Company, 3130 Hall Street, is in the market for two 1,000-hp. cross-compound condensing Corliss engines with direct-connected generators, 440-volt, alternating current.

VERSAILLES, MO.—H. Moser, owner of the Versailles flour mill, ice plant and power plant, contemplates increasing the electric plant this fall by about 130 hp. Mr. Moser took over the municipal electric plant last fall, which was practically rebuilt and the system changed from direct to alternating current.

GRAND FORKS, N. D.—Bids will be received by the Industrial Commission of North Dakota, Bismarck, until May 29, for construction of power plant, reservoir and filter plant, to include boiler, stokers, etc. C. L. Pillsbury, Metropolitan Life Building, Minneapolis, Minn., is engineer.

JOHNSON, NEB.—Bonds to the amount of $13,750 have been voted for the erection of transmission lines in Johnson and from that town to Auburn. The Intermountain Railway, Light & Power Company of Colorado Springs, Colo., will supply the electric energy.

BENOIT, MISS.—The local electric light plant has been sold. The new owner plans extensive improvements.

AMERICUS, KAN.—An issue of $18,000 in bonds has been voted for the establishment of a lighting system. Plans include the erection of a transmission line to Emporia to obtain energy for the proposed system.

HAVEN, KAN.—Bids will be received by George H. Thorp, city clerk, until May 20 for the establishment of a distribution system in Haven and the erection of a 14-mile transmission line to Burton, to cost about $25,000.

OSAWATOMIE, KAN. — Improvements to the municipal electric light and water plants, including the installation of a generating unit, construction of a dam, etc., to cost about $100,000, are under consideration.

Southern States

JELLICO, TENN.—The Consolidated Fuel Company of Pittsburgh, Pa., has purchased the property and mines of the Smoot Creek Coal & Coke Company of Jellico. Extensive improvements, it is said, will be made by the new owners, including the installation of new machinery, equipping the mines for electrical operation and installing electric lamps in all employees' homes.

MOSS POINT, MISS.—Bonds to the amount of $10,000 have ben authorized for the purchase of an electric light system. C. M. Fairley is city clerk.

MINDEN, LA.—At an election to be held soon the proposal to issue $60,000 in bonds for improvements to the electric light and water plant will be submitted to the voters.

PAWNEE, OKLA. — Bonds to the amount of $100,000 have been voted for improvements to the municipal electric light and water plant.

ALBANY, TEX. — The erection and operation of electric light plant is reported to be under consideration.

DALLAS, TEX.—The Security National Bank has had plans prepared by Herbert M. Greene Company, North Texas Building, for remodeling the Southland Hotel into a twelve-story building, to cost about $1,000,000. Plans include an electric alarm system.

DALLAS, TEX.—T. Dees, Guaranty Bank & Trust Company, Commonwealth Building, is having plans prepared for the erection of a twelve-story office building to cost about $1,700,000. A power generating plant will be installed.

FORT WORTH, TEX.—Bids will soon be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of a one-story wood-frame cylinder storage building, including industrial railway, drainage and electric lighting systems, etc., at the United States helium production plant. A deposit of $10 will be required for plans and specifications.

WACO, TEX.—The Central Texas Railway Company has awarded contract to the Central Texas Engineering & Construction Company, Amicable Life Building, for the construction of the first unit of its proposed railway to Temple. Gasoline motor cars will be used until a power house and transmission lines are erected.

Pacific and Mountain States

BLAINE, WASH.—The British Columbia Electric Railway Company, it is reported, contemplates extensions to its transmission lines in this vicinity.

OLYMPIA, WASH.—Contract has been awarded to the Westers Construction Company, Seaboard Building, Seattle, for the erection of a power house for the State Capitol group of buildings, to cost about $100,000.

ALBANY, ORE.—Work will soon be started by the Mountain States Power Company on its new 11,000-volt transmission line from Albany to Corvallis. The company is also planning extensive improvements to its plant and equipment.

SALEM, ORE.—Application has been made by Lyman Griswold of Portland to the state engineer for permission to divert water from the Santiam Creek, Whiskey Creek and Puzzle Creek to be stored in Marion Lake reservoir for power purposes. Mr. Griswold has also applied to construct the Clear Lake reservoir for storage of water from the McKenzie River.

BRAWLEY, CAL.—Definite steps have been taken by the Chamber of Commerce to secure a municipal electric light plant, to cost $10,000.

LOS ANGELES, CAL.—The Southern California Edison Company has applied to the California Railroad Commission for permission to issue $5,000,000 in bonds to finance hydro-electric developments on the Kern and San Joaquin Rivers, and to make additions to its transmission and distribution lines.

MARE ISLAND, CAL.—Bids will be received at the Navy Yard, Mare Island, until May 19, for electrification of the railroad track on the Vallejo-Mare Island causeway and the transfer yard at the Navy Yard, to include a 3,300-volt, single-phase, alternating-current overhead system of the catenary type. A deposit of $10 will be required for plans and Specification 4188, which may be obtained on application to E. L. Beach, Commandant, Navy Yard, Mare Island.

SAN FRANCISCO, CAL.—Contemplated improvements in the Divisadero district include placing electric lines underground, to cost about $150,000.

SUSANVILLE, CAL.—The Red River Lumber Company is negotiating for control of the properties of the Lassen Electric Company of Lassen, and also contemplates the construction of a transmission line between Westwood and Susanville.

FARMINGTON, UTAH.—The construction of a hydro-electric plant to develop 10,000 hp. for irrigation purposes is contemplated. A. F. Parker, 585 Twenty-eighth Street, is engineer.

DOUGLAS, ARIZ.—Farmers of the Sulphur Springs Valley are considering the construction of a power plant at Douglas, to cost about $2,000,000. It is planned to eliminate gasoline pumping plants and substitute an electrical capacity of 20,000 hp.

JEROME, ARIZ.—The power plant of the United Verde Mine was recently damaged by an explosion.

CASPER, WYO.—Contract has been awarded to the Gamewell Fire Alarm Company, Hastings Falls, Mass., for fire-alarm and police call system, at a cost of $17,072.

LOVELOCKS, NEV.—The Nevada Valleys Power Company has applied for extension of its service to points in Lander and other counties to the east.

Canada

LAKEFIELD, ONT.—The local electric plant, it is reported, was recently destroyed by fire, causing a loss of about $7,000.

NEW TORONTO, ONT.—Additions to the waterworks system, to include a new electrically driven pump and feeder main, to cost about $35,000, will be made.

NIAGARA FALLS, ONT.—A by-law to raise $30,000 has been passed by the City Council for improvements to be made by the Hydro-Electric Commission.

OTTAWA, ONT.—A survey of Nepean Township has been made by the Hydro-Electric Commission engineers, to ascertain whether a plan of electric light and power distribution is feasible.

OTTAWA, ONT.—Bids will soon be received by Stevens & Lee, 2 College Street, Toronto, engineers, for the construction of a hospital, to cost about $2,500,000. Electrical equipment, including electric elevators and electrical signal system, will be required.

PORT CREDIT, ONT.—E. A. James Company, 36 Toronto Street, Toronto, engineers, have been appointed to make report on the proposed waterworks system, to cost about $80,000. Present plans include pump house, electrically driven centrifugal pumps, turbine, three stage, about 600 Imp. G. P. M. Electric energy will be furnished by the Hydro-Electric Commission of Ontario.

WROXETER, ONT.—The Town Council is having plans prepared for the erection of a new hydro-electric power plant, to cost about $15,000. Mr. Flint, Hydro Building, Toronto, Ont., is engineer.

MONTREAL HARBOR, QUE.—Bids will soon be received by F. W. Cowie, engineer, care of Montreal Harbor Commissioners, for superstructure of a power house, to cost about $150,000.

(Issued April 20, 1920)

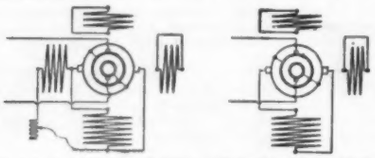
14,842 (Reissue). ELECTRICAL STARTING AND IGNITION SYSTEM; James K. Delano, Yonkers, N. Y. App. filed Feb. 10, 1920. Prevents battery from discharging through armature or through ignition circuit.

14,846 (Reissue). TWO-WIRE PARTY-LINE LOCK-OUT TELEPHONE SYSTEM; Talbot G. Martin, Chicago, Ill. App. filed Jan. 14, 1919. Lock-out systems, especially those for calling automatically or semi-automatically.

1,337,648. SYNCHRONOUS ALTERNATING-CURRENT MOTOR; Valere A. Fynn, St. Louis, Mo. App. filed May 9, 1916. Self-excited motors in which the revolving member receives energy from the supply while the stationary member carries the winding producing the unidirectional magnetization.

1,337,710. MACHINE-SWITCHING TELEPHONE-EXCHANGE SYSTEM; Alben E. Lundell, New York, N. Y. App. filed June 7, 1915. Transfers call from a manual office to a semi-automatic office.

1,337,711. TELEPHONE-EXCHANGE SYSTEM; Alben E. Lundell, New York, N. Y. App. filed Aug. 16, 1916. Subscriber informed of mistake if he either mistakes number of desired line or operates his dial inaccurately.



1,337,618. Synchronous Alternating-Current Motor

1,337,712. TELEPHONE SYSTEM; Alben E. Lundell, New York, N. Y. App. filed Oct. 10, 1917. Releases set of indicator lamps as soon as trunk has been plugged into jack of called line.

1,337,713. TELEPHONE SYSTEM; James L. McQuarrie, Montclair, N. J. App. filed Dec. 30, 1916. Setting movement of line finder directs separate connector switch.

1,337,714. AUTOMATIC TELEPHONE EXCHANGE SYSTEM; James L. McQuarrie, Montclair, N. J. App. filed July 2, 1917. Train of automatic switches controlled by a single auxiliary controlling switch.

1,337,715. TELEPHONE SYSTEM; James L. McQuarrie, Montclair, N. J. App. filed April 13, 1918. Automatic switches controlled by currents of different frequencies.

1,337,718. CLEANSING OF FERROUS AND NON-FERROUS METALS; Sumner R. Mason, Wilmette, Ill. App. filed Sept. 3, 1918. Parts submerged in electrolyte of cyanide, hydrate and an organic agent and are made terminals for a source of alternating current.

1,337,724. ELECTROLYZING APPARATUS; Claus N. Riber, Trondhjem, Norway. App. filed March 27, 1919. For alkaline chlorides.

1,337,725. ELECTRIC HEATING UNIT; Edwin A. Rutenber, Marion, Ind. App. filed April 22, 1918. Heat from entire surface of coil is reflected.

1,337,732. MAGNETIC GEARING; Hugh M. Stoller, New York, N. Y. App. filed Nov. 7, 1916. Eliminates mechanical contact and friction between transmission members and produces a noiseless gearing.

1,337,736. TELEPHONE-EXCHANGE SYSTEM; Tudor Van Amstel, New York, N. Y. App. filed Feb. 3, 1919. Indicating devices controlled by small step-by-step switches over metallic circuit.

1,337,737. PRODUCING CURRENTS OF DESIRED WAVE FORM; Hendrik J. Van Der Bijd, New York, N. Y. App. filed Sept. 30, 1918. Radiant-energy sensitive devices such as selenium produce currents of desired frequency and wave form.

1,337,739. ELECTRIC GENERATOR; Fred J. Whitcomb, Cleveland, Ohio. App. filed April 3, 1919. Improved mounting for permanent magnets of magnetos.

1,337,740. TELEPHONE-EXCHANGE SYSTEM; Samuel B. Williams, Jr., Brooklyn, N. Y. App. filed Jan. 25, 1919. Automatically informs operator of number and class of service of calling line.

1,337,741. TELEPHONE RECEIVER; James A. Wotton, Montclair, N. J. App. filed Nov. 3, 1917. Auxiliary receivers used when lines are noisy.

Record of Electrical Patents

Notes on United States Patents

1,337,748. TELEGRAPH SYSTEM; John H. Bell, South Orange, N. J. App. filed Nov. 21, 1917. Overcomes phenomenon known as "wandering zero" in line conductors having high electrostatic capacity.

1,337,752. TELEPHONE SYSTEM; Louis W. Carroll, Riverside, Ill. App. filed Nov. 24, 1916. Signaling mechanism economizes space.

1,337,753. SUPERVISORY SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Nov. 27, 1916. Conveys information to special operator if switch fails at any stage of its operation.

1,337,754. TELEPHONE-EXCHANGE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Aug. 1, 1917. Cords and plugs for link circuits.

1,337,755. TELEPHONE-EXCHANGE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Sept. 14, 1917. Signaling means for central-energy telephone systems.

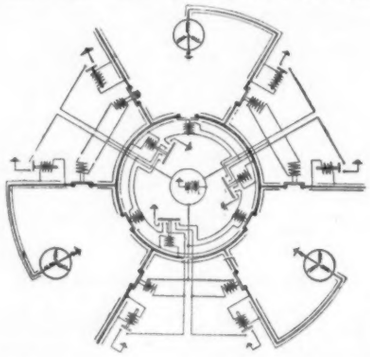
1,337,761. TELEPHONE-EXCHANGE SYSTEM; William L. Dodge, Maplewood, N. J. App. filed Aug. 7, 1918. Trunk circuits for completing connections between telephone lines terminating at different central offices.

1,337,779. ELECTRIC HEATING RESISTANCE ELEMENT; Leslie V. Leonard, Richmond, Victoria, Australia. App. filed April 5, 1919. High and low resistances wound on a continuous helical form.

1,337,782. TELEPHONE-EXCHANGE SYSTEM; Alben E. Lundell, New York, N. Y. App. filed May 17, 1918. Simplifies apparatus and circuit arrangement of connections between calling and called lines.

1,337,783. SIGNALING MECHANISM; Fred R. McMurry, Westwood, N. J. App. filed Feb. 8, 1918. Intercommunicating printing-telegraph systems.

1,337,784. AUTOMATIC SWITCH; James L. McQuarrie, Montclair, N. J. App. filed April 16, 1917. Electromagnetically controlled step-by-step switching device for use either as a selector or a connector.



1,337,866. System for Protecting Electric Cables

1,337,794. AUTOMATIC SWITCH; John N. Reynolds, Greenwich, Conn. App. filed Aug. 29, 1917. Saving in number of contact sets.

1,337,797. RELAY SYSTEM; Harry O. Rugh, Chicago, Ill. App. filed May 12, 1919. Breaks local energizing circuit of a telegraph sounder after a predetermined length of time.

1,337,811. METHOD OF MOLDING SEMI-SOLID SUBSTANCES; Bernard J. Allen, Stoke-Upon-Trent, England. App. filed Aug. 14, 1917. Obtains a deposit of clay plumbago by electrodeposition upon a mold.

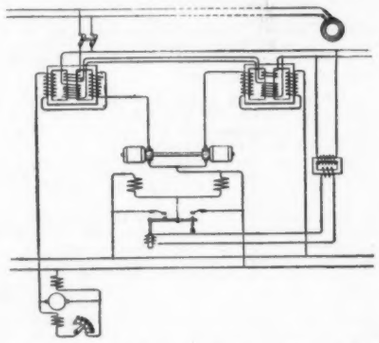
1,337,826. RHEOSTAT; Homer L. Dodge, Iowa City, Iowa. App. filed Aug. 23, 1917. Prevents loss due to unnecessary or undesirable heating.

1,337,839. ELECTRICALLY HEATED MELTING FURNACE; Leonard C. Harvey, Malden, Eng. App. filed Nov. 11, 1919. Protects the whole of the melting-chamber lining from local overheating.

1,337,853. SPARK-GAP-CONTROLLING DEVICE; George H. Taber, Binghamton, N. Y. App. filed March 8, 1919. Gaps increased or diminished at will.

1,337,854. REGULATING SYSTEM FOR ALTERNATING-CURRENT CIRCUITS; Louis W. Thompson, Schenectady, N. Y. App. filed July 10, 1910. Regulation of an alternating-current circuit accomplished without interruption of power currents and without use of heavy moving parts.

1,337,855. REGULATING SYSTEM FOR ALTERNATING-CURRENT CIRCUITS; Louis W. Thompson, Schenectady, N. Y. App. filed July 10, 1918. Prevents excessive voltages and excessive currents in primary windings of transformers and in a regulating system.



1,337,942. Regulating System for Alternating-Current System

1,337,858. TELEPHONE-BOOTH CONTROLLER; George E. Thum and Max Theimer, Elizabeth, N. J. App. filed Jan. 19, 1918. Holding customer as a prisoner in event of failure or refusal to pay charges.

1,337,866. SYSTEM FOR PROTECTING ELECTRIC CABLES; Frederick B. Whitaker, Rugby, Eng. App. filed Sept. 27, 1917. Systems which are grounded either direct or through a resistance or impedance at one or more points.

1,337,875. REGULATING SYSTEM FOR ALTERNATING-CURRENT CIRCUITS; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed Oct. 17, 1918. Regulates voltage of an alternating-current circuit by transformer provided with winding to space apart points on which are connected reactors, the inductances of which are varied so as to regulate effect of transformer upon alternating-current circuit.

1,337,885. X-RAY TRANSFORMER; William D. Collidge, Schenectady, N. Y. App. filed June 27, 1919. Compact arrangement of parts.

1,337,892. TELEPHONE RECEIVER AND RECEIVER SWITCH; Arthur Engelberg, Oakland, Cal. App. filed Jan. 27, 1919. Receiver short and light.

1,337,894. ELECTRODE; James K. Forshee, Chicago, Ill. App. filed March 18, 1920. Performs all functions of vacuum electrode.

1,337,904. X-RAY TUBE STAND AND TABLE; Ernest E. Greville, London, Eng. App. filed April 4, 1918. Fluoroscopy and X-ray photography.

1,337,915. HIGH-VOLTAGE TRANSFORMER; Svend E. Johannesen, Pittsfield, Mass. App. filed July 15, 1918. Adequate insulation and ventilation provided without barriers, the windings being supported independently of core.

1,337,933. ELECTRIC OSCILLATOR; George M. J. Mackay, Schenectady, N. Y. App. filed Jan. 27, 1916. Generate high-frequency waves substantially free from harmonics and of relatively large power.

1,337,942. REGULATING SYSTEM FOR ALTERNATING-CURRENT CIRCUITS; Edwin J. Murphy and Louis W. Thompson, Schenectady, N. Y. App. filed July 10, 1918. Regulation of alternating-current circuit accomplished without interruption of power currents and without use of heavy moving parts.

1,337,973. ENGINE-STARTING APPARATUS; Joseph Bijur, New York, N. Y. App. filed Nov. 16, 1916. For internal-combustion engines convenient in control and whose action is automatic.